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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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Forthcoming Events.

Institute of British Foundrymen.

DECEMBER 13.

East Midlands Branch:—Ordinary meeting at Derby. Paper by W. Molineux.

Newcastle-upon-Tyne and District Branch:—Ordinary meeting. "Foundry Facing Facts," Paper by H. Winterton.

Scottish Branch (Falkirk Section):—Ordinary meeting. "Nickel Additions in Cast Iron," Paper by A. B. Everest, Ph. D., B.Sc.

Wales and Monmouth Branch:—Ordinary meeting at Newport. "Studies in Foundry Sand," Paper by J. Hird.

DECEMBER 18.

Birmingham Branch (Junior Section):—Ordinary meeting. "The Manufacture of a Two-ton Press Body," Paper by G. M. Callagan.

DECEMBER 19.

Sheffield and District Branch:—Ordinary meeting. "A New View of the Composition and Structure of Cast Iron," Paper by J. E. Fletcher.

London Branch:—Annual dinner in London.

A Useful Reservoir.

There exist in England and Wales about one hundred Junior Technical day schools for boys, about one-fifth of which are situated in London. Last week we made a tour of several of these and ascertained at first hand just what type of instruction was being given, and under what conditions. During our tour we constantly bore in mind, for the sake of comparison, the conditions which the average entrant to the foundry industry "enjoys" for the first two years. In the schools, for 30 hours a week, they learn woodworking, including patternmaking and a limited amount of moulding; technical drawing; science (chemistry, physics and mechanics); mathematics (emphasis being laid on practical applications) and English. This last subject includes history and geography, but an industrial bias is given. About 10,000 boys are at present taking these courses. There is no necessity for us to outline what happens when a boy enters a foundry, as no typical case can be cited, and we leave it to our readers to form a comparison as to the relative merits. The one and only drawback is that the atmosphere of a works cannot be transferred to a school.

At the schools we visited we were impressed with the keenness of the staff to equip their boys with the type of knowledge which will be of most use to them in after-life. A great amount of latitude is given to the individual masters; one, for instance, allowed the boys to set and answer their own examination papers. For internal examination we can envisage no better method of ascertaining the knowledge which students possess, their interests and weaknesses. Another master was especially good at teaching his boys to create solid and paper models from drawings and *vice versa*. The standard reached through his enthusiasm was particularly high.

In our judgment boys so trained will have little difficulty in visualising drawings and their relation to patterns, moulds and finished castings. An exhibition is to be held at Olympia in the New Year which will cover the work done by the London Junior Technical schools. We have seen the lay-out of the stand to be occupied by the Poplar school, which will show how well-balanced is the training given for preliminary engineering work. We ask foundry executives specially to visit this exhibit, as we feel reasonably certain that they will agree with us that through the Junior Technical schools there has been created a reserve of admirably-equipped boys to take into their service as apprentices to the skilled crafts. Moreover, experience has definitely proved that these boys rarely sever their connection with higher education, and no inducement is necessary to get them to attend evening classes.

Wanted: A Foundry Dictionary.

A discussion about certain trade terms with a well-known figure in the industry recently left us with the impression that the trade badly needs a dictionary of technical and trade terms. We do not refer to metallurgical terms, several collections of which exist, but to practical trade terms, many of which have only a local significance.

Thus in an ordinary mould many people use the terms "cope" and "drag," but there are others who always have to stop and think out which part is which, and who would normally make use of alternative expressions. They are undoubtedly British terms, and are not used generally in America. There is, therefore, some justification for deciding whether we should use one pair of terms and standardise them. This point often arises when terms cease to be local and become national and even international. Perhaps it would be preferable to adhere to such terms as "top box," "bottom box," or "top part" and "bottom part." Several people who have recently prepared dictionaries of technical terms in various languages must have been up against this problem.

We feel an undoubted responsibility in this matter, because a technical or trade journal can do much to popularise the use of certain terms and discourage the use of others if a definite lead is given. Perhaps the new Technical Committee of the Institute of British Foundrymen can assist in the matter.

Take the question of sand treatment, now developing so rapidly. In a recent translation this question of terminology arose. It was felt that the term "used" sand is not quite adequate, and equally that the term "new" sand is not quite suitable for sands respectively after they have been in work and before they enter the foundry. After all, "used" sand is not necessarily spent from the foundry point of view. The term "black sand" is, of course, in wide use, as is the term "floor sand," but these may mean anything.

The question really goes deeper. The treatment of sand has introduced all sorts of terms, such as aerating, disintegrating, rebonding, reclaiming, conserving, rehabilitating and so on, none of which has a very clearly-defined meaning, and in any progressive process it is necessary that we should be able to use terms without ambiguity, without misunderstanding or the likelihood of misunderstanding, and, equally, without the necessity of defining our terms every time they are used. Metallurgical terms are already cared for. Nobody misunderstands terms like pearlite, ferrite and so on, although even here there is room for attention to certain terms like annealing, normalising, heat-treatment, which are used occasionally in a somewhat indiscriminate manner.

In processes there is an astonishing amount of uncertainty about the precise nature of various finishing processes, confusion as to whether a method involves electro-deposition, and so on.

XUM

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Superheating Cast Iron.

To the Editor of The Foundry Trade Journal.

Sir,—We were very interested to read in your issue of November 20 Mr. Hurst's "Note on the Influence of Superheating Molten Cast Iron." This is a matter which is of considerable practical interest in connection with the recently-advanced nuclear theory, which we have no doubt is capable of explaining a good many of the puzzling inconsistencies often met in cast iron.

We notice Mr. Hurst's precaution with regard to the spinning speed and mould temperature, but we do not see any reference to the temperature of the metal when pouring. We presume that in order to keep the conditions comparable the superheated metal would be allowed to cool down to the same temperature as the normal material before pouring, but, on the other hand, it looks rather, from the greater number of defects on the outside of the casting, as though the pouring temperature of the superheated metal may have been higher.

We notice that the superheated material shows a duller and blacker fracture, which suggests that the structure might be of the ferrite-graphite type which is usually associated with a low combined carbon, but the analysis given of 0.7 per cent. does not bear this out. Perhaps the difference in silicon may partly be the cause.

We are surprised to notice that superheated material shows a greater tendency towards openness on the inside of the casting, as, so far as our experiments go, this is more likely to happen when the conditions are such as to ensure plenty of nuclei for the development of comparatively coarse graphitic carbon which is usually associated with the pearlitic structure.

We mention the question of metal temperature because we have found, after long experience in making centrifugal castings in metal moulds and in various chilled castings of which we have experience, that the casting temperature is of very great importance in its effects on the structure of the casting. The fact that these points have to be so carefully considered emphasises the great difficulty of trying out theories under actual working conditions. The already difficult task of producing a consistently high-grade material becomes all the more arduous with the greater number of factors which have to be taken into account. On the other hand, there is no doubt that it is essential to take them into reckoning if consistently high quality is to be maintained.—Yours, etc.,

For the British Piston Ring Company, Limited,
T. R. Twigger,
Technical Department.
Holbrook Lane, Coventry, England.
December 3, 1930.

Nickel Additions to Cast Iron.

To the Editor of The Foundry Trade Journal.

Sir,—I have read with great interest the report of the Paper given by Mr. J. E. Hurst on "Oil-Hardening and Air-Hardening Cast Iron," published in your current issue. There is to-day a growing demand for special hard cast iron for such applications as cylinder liners and piston rings in automobile construction, as a solution of some of the troubles of rapid wear which have been experienced in the past few years. The success of centrifugal cast iron for this purpose is too well known to need stressing here. Investigations have, however, been under way for some time for the development of a cylinder material which will still further conform with the producer's requirements of ready machinability and also with the user's need for a hard-wearing quality. Under modern engine conditions the latter appears to be opposed to the former, and consequently the realisation that cast iron is capable of heat-treatment has led to the development of material such as described by Mr. Hurst, in which cylinder liners and piston rings, whilst readily machinable as cast, can then be heat-treated so as to develop high hardness with good mechanical properties and a fine close structure.

A point raised by Mr. Hurst in his Paper, however, requires some comment. In Fig. 1 a section of a casting is shown in which spots of "F" Nickel which have not dissolved in the iron are apparent. The author's remarks referring to this illustration may, perhaps, convey a wrong impression to the general reader, for although Mr. Hurst met trouble in obtaining solution of the nickel when it was added in this form, nevertheless such difficulty does not generally occur in practice. It is, moreover, of great interest to note that subsequently the nickel addition was successfully made by using pure nickel, this having a melting point some 200 deg. C. higher than that of "F" Shot, but which in the present case gave, in the form of clippings, the most satisfactory result. About 60 per cent. of the nickel which is being consumed in cast-iron applications in this country to-day is added as Nickel "F" Shot, and in many cases by foundries who are taking regularly between ½ and 1 ton of nickel a month. The methods by which the nickel additions are generally being made have been dealt with extensively elsewhere and need not be repeated here.

Reference to a recent note by Mr. Hurst, published in The Foundry Trade Journal for November 20 under the heading of "The Influence of Superheating Molten Cast Iron," throws some light on his present experience. Perhaps Mr. Hurst will correct me if I am wrong in my deductions, but it would appear, from the data given in this article, that the average tapping temperature of the iron in his foundry is round about 1,250 deg. C. Although this temperature is, no doubt, entirely satisfactory for castings made by the special method employed, nevertheless it would seem fair to state that, compared with ordinary foundry practice, this temperature is low.

In the next place Mr. Hurst refers to the fact that 50 lbs. of the metal is taken at a time for making up the raw castings for cylinder liners or piston-ring pots. The addition of nickel to this small quantity of iron is again a likely cause of trouble, for, as will be obvious, with so small a quantity of metal, even with hot iron, a rapid heat loss is inevitable, with increased difficulty in manipulation before casting.

Lastly, in Mr. Hurst's present Paper it will be seen that the nickel content in his iron runs as high as 3.37 per cent., and it may be that the author's experience has been caused by the necessity of making a ladle addition of a quantity of nickel as great as this.

To sum up, it would appear that the difficulty Mr. Hurst has experienced with "F" Shot can be put down to the following causes: (1) Relatively cold metal; (2) the necessity of alloying a small quantity of iron, and (3) the necessity of making too large an addition of nickel to the iron in the ladle.

Anyone conversant with the recent published work on nickel in cast iron will realise that these points have been appreciated, and that special precautions have been suggested in order to deal with them.

The experience of Mr. Hurst illustrates well the necessity of suiting the form of addition to the type of work handled, and with the variety of forms of nickel available there need be no difficulty encountered provided that due consideration is given to the special features of each case.—Yours, etc.,

Arthur B. Everest.

December 6, 1930.

Random Shots.

You have all heard the story of the man who says to a chance acquaintance at a friendly evening gathering, "Who is that very ugly woman coming along just now?" and the friend replies, "That is my wife." How to get out of the subsequent embarrassing situation is a pretty problem in social etiquette.

* * *

One variation of the story goes on, "Sorry, my mistake," and the rejoinder is the sadly spoken "No, mine." Another variation merely gets the struggling inquirer a little deeper in the mire, for he stammers, "Oh, I don't mean that one, I mean the very ugly one by her side," only to hear the answer, "Well, that's my sister."

* * *

A pleasant change came across my way this week, for Number One goes on brutally "Why, on earth, do you bring her out then?" and the answer was, "Because if I didn't I should have to stay at home and look at her all night."

* * *

They all remind me of the Yorkshire story of the bridegroom who asked the minister what the fee was. The clergyman looked at the groom and said gaily, "Oh, just give me what you think she's worth." The groom took out a coin and pressed a shilling into the clergyman's hand. The latter looked at the bride for a moment and then returned ninepence change.

* * *

The railway companies' wage proposals remind me that in every country in Europe wages have fallen during the past six months more than in Great Britain. Taking a figure of 100 for this country, the International Labour Office reports that wages in Austria in six months fell from 52 to 48, in Germany from 77 to 73, in Italy from 43 to 39, for Holland from 87 to 82 and for Spain from 45 to 40; for Ireland from 97 to 93, for Canada from 165 to 155, for United States from 197 to 190. These figures are based on time rates.

* * *

Denmark and Sweden, as is well known, have wage rates even higher than Great Britain. They are small countries and hard-working people, and the burden of empire does not press them so hardly as it does us. For these two countries the figures are not comparable, because they are on piece rates, and for time rates they would be lower. Denmark shows an advance from 112 to 113, while Sweden shows a drop from 113 to 109.

* * *

A strange boy asked a manufacturer for permission to use the telephone, which was graciously granted. The boy rang up a firm and asked if they wanted a smart office boy. They replied in the negative. He persisted, and asked if they were likely to have a vacancy in a week or two weeks' time. They replied, quite categorically, that they had a very good office boy, that he was giving them every satisfaction and that they had no intention of making any change. The boy rang off, and the manufacturer, intrigued by this conversation, asked him if he wanted a job. "No," he answered. "But you have just been making inquiries about a job." "Yes, I know," said the boy. "That was my firm, and I was just finding out how I stood with them, and whether I ought to be looking for another job." Moral: It is a wise boss who knows his own office boy.

Marksman.

The Sand Foundry of the Glacier Metal Company, Limited.

Owing to expansion of business, the sand-foundry department of Messrs. Glacier Metal Company, Limited, of Alperton, Middlesex, has recently been transferred to a new well-lighted and excellently-ventilated shop.

The foundry, which is shown in Fig. 1, covers an area of 120 ft. by 150 ft. Along one end of the shop all melting is conducted, and, running at right angles to the furnaces, are a series of moulding benches and casting racks. The floor is of concrete, and the output is virtually limited to gun-metal bearings.

Melting Plant.

The output, which ranges round about 15 tons per week, is melted in a variety of furnaces, all of which have been designed or modified to incorporate oil-firing.

Proceeding from the entrance to the foundry, there are 6 pits of the Carr type, 3 "British" pit furnaces, a Sklenar midget, 3 Alldays and 2 Morgan-Wright tilting crucible furnaces. Practically all these have a brass capacity of 350 to 400 lbs.—The midget furnace—the latest to be installed—is turning out 400 lbs. every half-hour, and under the conditions there existing is the most economical unit. The whole of the melting plant is spanned by a common canopy, carrying a dozen chimneys. The natural draft created has proved an excellent system for keeping the shop free from fumes.

All moulding is done on benches by hand, about 24 moulders being employed. Coremaking, which resolves itself into that of making round cores, is carried out by 3 boys. The usual Mansfield, old sand and coregum mixture is used, with an occasional admixture of linseed.

Moulding machines have been tried, but up to now have not proved too successful, as any movement between the two halves of the box is liable to cause slight modification in the thickness of the casting. As most modern bearing castings carry a grinding, and not a machining, allowance, great accuracy in moulding is an essential. In this connection it is interesting to note that competition from stampings is being met by the greater dimensional accuracy of the castings taken over a long run. Stampings are dimensionally correct when the die is new, but progressively deteriorate with the wear of the die.

A double compartment, each about 4 ft. sq., coke-fired by a unit placed outside the structure, and a gas-fired Richmond stove have been provided for core drying.

The sand plant, consisting of a mill and Herbert aerator, together with the sand bins, are conveniently placed alongside the main road through the works. The new sand, arriving by lorry, can be emptied directly into the bins.

Cleaning.

The castings are cleaned by barrelling in two tumblers of about 3-cwt. capacity, installed in the open air. Additionally, there is a Jackman sand-blast cabinet. Gates are removed by two Roberts' git cutters, whilst six double-ended grinders complete the finishing process.

The whole of the manufacturing processes at the Glacier Works are controlled from the laboratory, shown in Fig. 2. One cannot help being impressed when touring the works of the world-wide connection which has been established by the enterprising concern. Moreover, there was no evidence of lack of orders. We gratefully acknowledge the facilities placed at our disposal by Mr. M. Melhuish, the works engineer.

FIG. 1.—SHOWING THE FOUNDRY OF MESSRS. GLACIER METAL COMPANY, LIMITED.

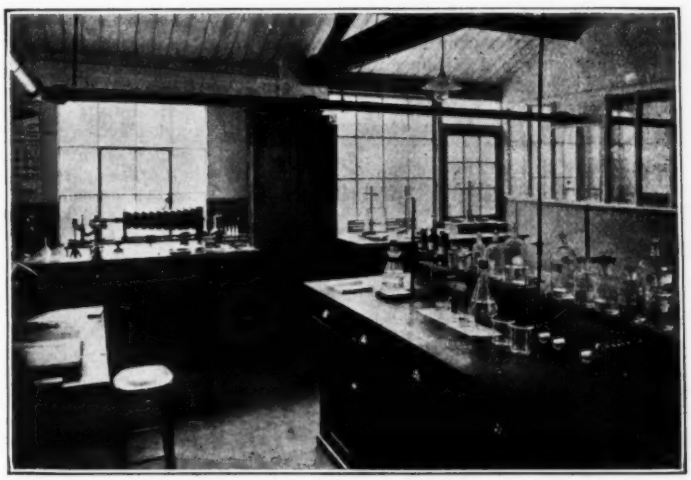


FIG. 2.—THE LABORATORY OF MESSRS. GLACIER METAL COMPANY, LIMITED.

Future of the French Steel Industry.

The question of the future prospects of the French iron and steel industry was discussed by M. ALEXANDRE DREUX, Vice-President, at the annual meeting of the Aciéries de Longwy. Having traced the development in the past fifty years, M. Dreux stated that one might be tempted to deduce from it the course which will be taken in the next fifty years. On this point ideas had been expressed and figures put forward which were so extravagant that it was necessary to utter a warning against conclusions which misinformed persons might draw from them.

It was no secret that the mineral resources in the Lorraine basin, which for some years before the war were held to be almost inexhaustible, were not unlimited. At present these resources were being scheduled and the Administration of Mines had studied the measures to be taken for conserving them from being inconsiderately wasted. In particular the Administration had recommended that the exports should be restricted. For the rest the Aciéries de Longwy had reached a similar conclusion and had decided to limit their sales of ore henceforth in order to ensure a sufficient life for the undertaking. Although already well provided for, the company had had the good fortune to obtain for their Valleroy branch the lease of some concessions belonging to successors to the former German owners, and, as a consequence, their mining properties were completed and consolidated on the basis of the present rate of consumption for a total period of over a century. But other works, particularly among those abroad, were much less well provided for, and in the conclusion of its study the Administration of Mines, discounting a most moderate annual increase in the production, estimated that the Lorraine basin will be exhausted within 50 years.

For the rest the Vice-President stated that it was known that the industry had not the leisure to arrange its depreciation as it would like. While taking advantage of the rather long period which had still to run before the company's mines were exhausted, they were constantly obliged to witness technical progress compelling them prematurely to discontinue installations which were still powerful and intrinsically capable of good work, solely because new processes permitted of the manufacture of the same products in a more economical way. And as, according to a general law, modern plants were more perfect and more complicated, they were also more onerous than the old ones which they replaced. In the circumstances, if they did not wish to run the risk of losing their position, they were compelled to invest gradually increasing amounts in their undertakings.

Duronze—A High-tensile Silicon Bronze.—Duronze is the name of a new alloy developed by the Bridgeport Brass Company, Bridgeport, Conn. It is a new high-tensile silicon-bronze with a tensile strength of about 42,500 lbs. per sq. in. in the annealed condition. After cold drawing it is reported to have a tensile strength of 129,900 lbs. per sq. in. and not to be brittle as is the case with some brass and nickel-silicon alloys. Further facts are as follow: In rod form, with a tensile strength of about 100,800 lbs. per sq. in., it can be readily upset and roll-threaded in the manufacture of cap and machine screws. Heads formed by the cold upsetting process are not weak and brittle. Duronze can also be hot-worked and hot-forged. It is claimed to resist corrosion better than brass or copper, standing up remarkably well in dilute sulphuric and dilute hydrofluoric acid. A further claim is that it is immune from season cracking, making it very desirable for use in outdoor construction work, where weathering, sudden changes in temperature and ammonia gases destroy the usefulness of brass bolts. The material is obtainable in sheet, strip, rod and wire form.—"The Iron Age."

XUM

Testing Welds.

METHODS MORE RELIABLE.

According to an article in a recent issue of "Steel," quality of welded joints and testing procedure to determine efficiency non-destructively always evoke extended discussion among welding authorities. In the infancy of the industry, states the article, lack of test methods impeded acceptance of welding. Even at present no universal tests can be applied, but satisfactory performance of welded structures has established a confidence thereby permitting wide application of the various processes. During this period technique has improved, physical properties of welds have been raised and considerable progress has been achieved in the line of testing and inspection.

In a symposium of the American Bureau of Welding, MR. J. W. OWENS submitted tensile-test recommendations for consideration of the committee on standard tests for welds. He mentioned that the values for ultimate stress, yield point, per cent. elongation and reduction in area should be determined separately for the base and weld metals by the use of round specimens, and suggested a specimen having a diameter of 0.505 in. and a gauge length of 2 in. Where this is impractical, he stated, any diameter of specimen may be used provided the gauge length is four times the diameter.

Special Shape Suggested.

The value for fusion for both brittle and tough welds should be determined by a rectangular specimen transverse to the joint, with parallel sides and edges, having the weld section locally reduced 25 per cent. in width by a curved reduction at the edges of the specimen, the radius of curvature being four times the width of the reduced weld section. Continuing, he stated the base metal used in the preparation of test specimen for welds should have the same properties as that used in the structure on the class of work for which tests are made. Lastly, he stated, the use of swivel holders should be required for testing the round weld and base metal specimens.

MR. W. B. MILLER, outlining the present status of the bend test, mentioned that the consistency of the results is excellent and constitutes a main advantage. For homogeneous material, he explained, similar specimens of the same material not only give the same results, but the same material when tested in various thicknesses gives the same results, showing that the test measures inherent properties of the metal. Any inconsistencies in results of weld tests may be due to weld irregularities, he stated, rather than to any unreliability of the method.

Fatigue Strengths Measured.

MR. C. H. JENNINGS presented data on the fatigue strength of butt and fillet welds and the impact strength of butt welds and arc-deposited metal. Fatigue strength of butt welds, he said, is shown to depend upon the type of joint and the specimen used; fatigue strength of fillet welds is affected slightly by the size of the weld and by machining the radius at the base of the fillet. He directed attention to the fact that impact values for arc-deposited metal are higher than those obtained from welded joints, according to test data. Annealing welds below 840 deg. C., he explained, has little effect upon their impact strength, while annealing above this temperature greatly reduces their impact values.

MR. G. DOAN, discussing the use of gamma rays for examining welds, pointed out that the radium apparatus may consist simply of a capsule about the size of a 22-calibre cartridge containing the source of rays. The portability of such a capsule would allow it to be used in such places as the top of a partly-constructed bridge of skyscraper, the interior of complex steel framework or even under water. It is possible, he explained, to radiograph welds in places inaccessible to the usual radiographic apparatus. Exposures can be made at night, and since the rays are emitted in all directions from a source, time and cost may be minimised by placing a large number of test objects about the source and taking a dozen or more photographs simultaneously.

A Paper on the quality of welded joints and testing procedure to determine the properties of joints in pressure vessels by MR. J. C. HODGE prompted wide discussion. The non-destructive test or exploration of every inch of the main welded joint of a pressure vessel was acclaimed by the speaker as the most important factor in the testing procedure. As an accessory to the physical test specimens, which offers only a means of determining the physical values of the samples of the welded joints, he contended, the non-destructive test method gives a close examination of the welded joint, so that it is impossible for dangerous sections to be presented in the welded joints of the drum.

Development work on apparatus suitable for this method of testing has been concentrated on fissure detection by electro-magnetic means and by the X-ray method. The latter method of examination can be used to explore every portion of the main longitudinal or circumferential joints of a welded pressure vessel at an estimated cost of 30 cents per foot for ½-in. plate, 38 cents per foot for 2-in. plate, and $2.63 per foot for 3½-in. plate. The radiographs are made with a standardised technique, the voltage applied to the tube and the time of exposure being chosen to suit the wall thickness. For thicknesses of 2 in. or more, 210,000 to 220,000 volts are used, and the time of exposure chosen to give a satisfactory view. For smaller thicknesses an exposure of 2 min. and a reduced voltage is used.

Direct Current Employed.

In testing by electro-magnetic means the shell to be explored is placed on a movable platform, the speed of which can be adjusted. The drum is brought into contact with two brushes attached to the cross beam of the frame so that the welded joint of the shell lies between. A heavy direct current is brought into the brushes and passes through the welded joint. The current in the welded plate sets up a magnetic field around the plate, and as the shell travels under the brushes any deviation or distortion in the direction of current through the plate in passing around flaws or defects within the welded plate causes a corresponding deviation in the direction of the magnetic field around the plate. The changes in the direction of the magnetic flux around the plate are detected and measured by a balanced coil unit, the changes in the current of which are amplified to control relays for the operation of the recording apparatus.

As the metal is reduced in size, the deformation of the grains is accompanied by a rotation so that eventually the crystallographic axes of the grains becomes essentially parallel. In fine-grain metal, where the grains are oriented in a random fashion, the resultant pattern is composed of a series of concentric rings. If the material is fine grained but only one or two orientations are present, the pattern consists of only six segments of the rings, he stated. These segments may be short as to be mere spots, depending upon the completeness of the parallel orientation.

The appearance of asterism in X-ray diffraction pattern is of the greatest importance in showing the presence of internal strains in metal samples such as castings and welds, the author pointed out. One can determine in what proportions these strains exist and to what extent they have been eliminated by recrystallisation. In conclusion, he described the results obtained from a typical welded sample.

Varying Endurance Limit.

MR. G. E. THORNTON, discussing a series of investigations made to determine the endurance limit of butt joints made by different welding processes, pointed out that welded specimens made from firebox steel do not equal the endurance limit of that material unwelded.

British Industries Fair.

SIR ROBERT DONALD ON OVERSEAS PUBLICITY

Addressing the annual meeting of Industrial Newspapers, Limited (proprietors of THE FOUNDRY TRADE JOURNAL), yesterday, SIR ROBERT DONALD (the chairman), having dealt with the accounts, referred to trade papers and advertising generally. During the last ten years, he said, there has been given tremendous impetus to the business of advertising in this country, and it is interesting to note that Government Departments, which up to the present have not taken much part in this stimulus to salesmanship, have now published a report which indicates a move in the right direction. Unlike the Government of Canada, they have not, until now, realised that the best way to fight under-consumption is to advertise. The Dominion Department of Trade and Commerce has been using the daily Press and the business newspapers of Canada to a considerable extent during the last six months to carry on a vigorous campaign advocating increased production in Canada and advising consumers to buy Canadian products.

In this country we have a lamentable contrast, with one Government Department in possession of funds which it appears unable usefully to employ in advertising, while another Department, whose needs are greater, is being starved for lack of support. I refer to the Empire Marketing Board and the British Industries Fair respectively. A Committee has just recommended that the amount for advertising the British Industries Fair should be increased from £25,000 to £100,000 a year as a minimum. That is the only demonstration that we, as a nation, give the world that we have goods to sell. It is organised to attract foreign buyers and to show that our goods compare favourably in quality and price with any in the world, but hitherto we have made a lamentable failure in telling the world about the Fair.

The merchants in the Overseas Dominions complain of our obsolete methods of salesmanship, and they have reason. As an example, the sum allocated to be spent on circulars, posters and advertising the British Industries Fair in the Empire this year was £5,850. This was altogether inadequate when we consider the opportunities for selling British manufactured goods among our own people.

For Canada and Newfoundland the sum was £1,700; for Australia £1,200; India and Ceylon got £500; and British West Indies £150.

Less than half that amount was considered sufficient to cover the rest of the world. It would be humorous, were it not so serious, to realise that an effort was made with an expenditure of £25 for the whole of China to tell merchants of that great country, with its international ports, what the British Industries Fair stands for. As it was found impossible to spend such an insignificant sum on publicity in that vast country, it has been cut down to nothing this year. The whole of Japan, with its sympathetic market for British goods, had also to be overlooked. For Poland, a new country, ready to buy British goods, £100 was allocated. In France, with forty million people, the merits of the Fair were expected to be made known by an expenditure of £200. And so I could go on through the countries of the world.

A Contrast.

It is great credit to the Department of Overseas Trade that, in spite of these handicaps, it manages the Fair with extraordinary efficiency. On the other hand, the Empire Marketing Board has been suffering from an embarrassment of riches and an inability to spend its grant to the full on useful advertising. So far it has given the major portion of its funds to research, but with the depressed state of trade in this country we envy a college in Trinidad which has been fortunate in obtaining an annual grant from the Empire Marketing Board equal to the total sum spent on advertising the British Industries Fair.

A Heat- and Corrosion-Resisting Cast Iron.*

An interesting development in the search for a cast iron with improved resistance to heat and corrosion is the production of an alloy containing about 75 per cent. ordinary cast iron, 4 per cent. chromium and the balance Monel metal. This composite alloy is known as "Nimol" and may roughly be described as an improved cast iron with notable heat-resisting properties, which render it suitable for many services where ordinary cast iron has a limited life. The properties, workability and cost of this material indicate that it should have many applications where heat- and corrosion-resistance are factors.

Physical Properties.

Nimol is harder and wears better than brass and may be used for many purposes for which brass is now specified. Its coefficient of expansion is so similar to that of cast iron that parts working in conjunction with ordinary cast iron neither work loose nor jam. Nimol is stronger and tougher than cast iron, withstands the destructive effects of temperatures up to 600 deg. C. and does not suffer from growth at high temperatures. Intricate castings may be made in Nimol almost as readily as in cast iron. The physical properties of the material are given in the table below:—

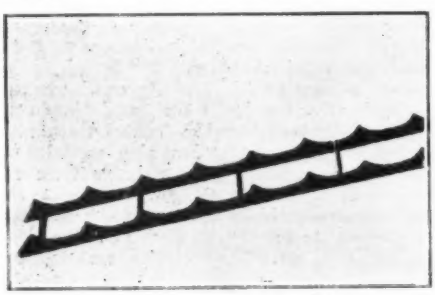


FIG. 1.—SHOWING A NIMOL PERRIT HAVING A LIFE OF 9 MONTHS.

Ultimate tensile strength at room temperature	9 to 12 tons per sq. inch
Elongation	1½ per cent. to 2½ per cent.
Brinell hardness	200 minimum
Shrinkage allowance for patterns	$\frac{5}{32}$ inch in 12 inches
Specific gravity	7.686
Electrical resistivity	94.77 microhms. per c.c.
Permeability	1.4
Remanence	0 approx.
After 30 days' heating at 600 deg. C.:—	
Decrease in volume	0.4 per cent.
Increase in strength	3 per cent.

Resistance to Heat.

Nimol may be used at a red heat over prolonged periods without the destructive growth characteristic of ordinary cast iron. A sample of specially good quality cast iron after 30 days at 600 deg. C. was found to have lost 37 per cent. of its strength and had increased in volume by 5 per cent. Nimol, under the same conditions, lost no strength and its volume decreased by 0.4 per cent., so that temperature effects up to 600 deg. C. may be neglected.

Industrial applications over many months, where exact temperatures are not readily available, show that the upper limit of safe working is not less than 850 deg. C. and may be higher. As an instance, several tons of Nimol have been used as superheater tube supports and spacing pieces in Yarrow boilers. These were fitted on transatlantic passenger liners where the demand for increased speed necessitated installing boilers of very high duty in which the superheater tube area was increased by lengthening the individual tubes. Trouble experienced at sea through deflection of the greater length of unsupported tube was entirely overcome by employing Nimol castings as tube stiffening and spacing members. After seven months' service at 1,000 deg. Fah. the castings were reported on as being as good as new, and after 15 months there are no reports of failure.

A kindred application of Nimol has been for enamel-ware fusing supports or "perrits," a typical example of which is shown in Fig. 1. Many firms have already standardised on Nimol supports for carrying stove parts and baths in their enamelling furnaces. It has been found in practice that at a normal working temperature of 850 deg. C., Nimol supports last 6 to 7 months compared with 7 to 10 days for ordinary cast iron. Further, with some designs of cast-iron perrits, warping occurs in two planes; in the case of Nimol perrits, warpage is confined to one plane and the important burning points are maintained at their original level.

Resistance to Acids.

Nimol also possesses important corrosion-resisting properties, and tests have shown it to be much more resistant to attack by sulphuric acid than is ordinary cast iron. Tests carried out with strong aeration and with adequate supplies of fresh acid to eliminate any chance of saturation from the products of corrosion, gave excellent results, as may be seen from the illustrations. With sulphuric acid, tests made at room temperature in a 5 per cent. aqueous solution showed that the loss in weight of the Nimol specimen was only 1/100th that of cast iron. The actual figures of loss in weight on a 100-hr. test were: Nimol, 0.24 gm.; cast iron, 24.7 gms. Similar tests without aeration give a ratio of 1 to 500.

Nimol has been found more suitable than cast iron for use in contact with a 10 per cent. aqueous solution of hydrochloric acid at room temperatures, without aeration. It is not suitable for use with nitric acid, but its enhanced resistance to most other acids and the instances given suggest the type of work for which it may be considered.

Atmospheric Corrosion.

Pieces of Nimol and ordinary cast iron were turned ¾ in. dia. by 1½ in. long and put on the roof of a laboratory at Cathcart, Glasgow, in June, 1927. These were examined after 15 months' exposure to the elements. The Nimol had a thin, closely-adhering coating of rust and had gained slightly in weight. When the rust was removed with emery paper the surface was found to be practically unaffected, and the tool-marks were still quite visible. The ordinary iron had a heavy coating of rust, in spite of which it had lost weight. The surface, after emerying, was found to be very deeply pitted and could not be polished.

From the viewpoint of corrosion-resistance, Nimol offers a cast material of importance in the production of pump impellers and casings in place of acid-resisting bronzes, since caustic and weak sulphuric-acid solutions are without effect upon it.

Much time must elapse before complete data are available as to the ultimate life of Nimol, but a pump which was examined after three months' service in a chemical works gives an indication as to what may be expected. This pump, of the normal Weir construction, size 5 in. by 4½ in. by 12 in., is fitted with a Nimol bottom casting, comprising water end and valve boxes. The pump bucket and liner, with the valve seats and pump rings, are of Nimol, while the pump rod and valves are of Monel metal. When the pump was opened up it was found to be in perfect condition. The bucket had suffered from slight scoring, caused by grit when the pump was first started, but the valves, seats, liner and bucket showed no signs of corrosion or erosion. The working conditions are severe. For three days the pump works continuously night and day, handling a liquor composed of molasses, yeast and water, with about 1 per cent. of sulphuric acid, at a temperature of 90 deg. Fah. For the remainder of the week it stands idle.

Miscellaneous Uses.

There are many uses for which Nimol possesses the needed properties. These include retorts for fuel carbonisation, pans for fusing caustic alkalies, furnace louvres, sewage sluice valves, waterworks pumping and engine liners.

The fact that Nimol is successfully meeting severe service requirements in many chemical and metallurgical plants seems to indicate a bright future for this material. So far its non-magnetic properties have not been utilised, but it is possible they will eventually find some sphere of application, especially if this need is felt in a material subjected to high temperatures.

* Extracted from the November issue of the "Nickel Bulletin."

I.B.F. Branch-Presidents.

No. 4.—LANCASHIRE BRANCH.

Mr. R. W. Stubbs was educated at the Victoria Park School, Manchester, and then at the Manchester Grammar School. He studied metallurgy, machine drawing and chemistry at the College of Technology, Manchester, and joined the firm of Messrs. Joseph Stubbs, Limited, where he spent many years in the foundry as moulder and coremaker, etc.

MR. ROY W. STUBBS.

Mr. Stubbs served in the war as a gunner in the R.F.A., and at the end of the war returned to an executive position in the foundry of Messrs. Joseph Stubbs, Limited. Later he joined the board of directors and is now in charge of the foundry. He joined the Lancashire Branch of the Institute of British Foundrymen in 1919, and also is a member of the Manchester Association of Engineers. He is a member of the Executive Board of the National Ironfounding Employers' Federation and of the Executive Committee of the Manchester and District Ironfounders' Employers' Association.

D

Breakage of Rolls.

At a meeting of the South Wales Institute of Engineers, held at Swansea on November 18, Professor Frederick Bacon, M.A., M.I.Mech.E., read a Paper on the subject of "Fatigue Stresses, with Special Reference to the Breakage of Rolls." Professor Bacon, who is the head of the Engineering Department of the University College, Swansea, treated his subject mainly from a mathematical viewpoint. His conclusions are summarised below:—

(1) The behaviour of rolls is inextricably interwoven with the term "fatigue" as employed in the strength of materials, because the working loads induce repeated cycles of varying stress.

(2) Whenever the freshly-fractured faces of a broken roll exhibit hair-crack markings, the fracture is correctly described as a "fatigue fracture."

(3) Whether normal working stresses ever exceed the "fatigue limit" of sound rolls of good-quality iron requires further investigation to decide; but it is certain the factor of safety against self-induced fatigue—*i.e.*, fatigue brought about by loading stresses only—is small having regard to the numerous adverse contingencies it has to cover—very much smaller than the ratio:

$$\frac{\text{Modulus of rupture}}{\text{Major principal stress}}$$

which is the factor of safety against breakage under static loading.

(4) In the majority of roll fractures showing hair-crack markings it is likely the initiation of surface hair cracks is due to causes other than or additional to the repeated cycles of normal working stress. But the subsequent "crack-spreading stage" must be expected to behave in much the same way as in the case of a laboratory fatigue test.

There are nearly always wide discrepancies between service conditions and the artificially simplified conditions of a laboratory test. On the whole, the breakage of rolls is more nearly related to laboratory fatigue tests than most cases of fatigue met with in practice.

(5) A critical examination of all available data as to fatigue limits and endurance ratios for cast irons suggests that the alternating fatigue limit of the grey-iron core of a good roll is likely to be about 5 tons per sq. in. just below the mottle. The fatigue limits of the mottle itself—which has to carry the greatest stress when the roll is worn out—are quite possibly lower, due to the composite structure.

(6) In a new roll, the outer surface of the chill is called upon to carry the greatest stress. The author has failed to find any record of fatigue tests on chilled or white cast iron. As a provisional estimate, ± 8 tons per sq. in. is suggested for the fatigue limits; but this is little more than a guess based on the assumption that the endurance ratio of chilled cast iron is about the same as has been found for high-tension cast iron almost devoid of free graphite. It entirely ignores the peculiar structure of the chill crystals as found in a large roll, viz., coarse columnar crystals.

(7) Such experimental evidence as is available suggests that the temperature at which hot rolls work is not sufficiently high seriously to impair the tensile and fatigue strength of the grey-iron core; but nothing definite appears to be known about the mechanical properties of chill and mottle at elevated temperatures.

(8) A week's work is roughly the equivalent of 20,000 stress cycles. Whether surface hair cracks will spread quickly, slowly or not at all is a delicate balance. A difference in stress of 1 ton per sq. in. may be expected to make all the difference between a fatigue life which outlasts the useful life and the breakage of a roll after only a few days' service.

(9) Mathematical investigation shows that the superposition of a constant torque T will make no difference whatever to the fatigue life of a roll subjected to alternating bending moment M provided

$$\frac{T}{M} < \frac{\text{Ultimate tensile strength}}{\text{Alternating fatigue limit}} < 2, \text{ say.}$$

As in the leading bottom roll of a train of four mills, T/M is less than 1.3, there is a generous margin for confidently asserting that, so far as liability to fatigue failure is concerned, it is to be expected that bottom rolls will be neither more nor less likely to break than top rolls.

(10) The major principal stress in the leading bottom roll of a train of four mills is 30 per cent. higher than in a top roll; so if the major principal stress was the criterion of failure, bottom rolls would be much more liable to break than top rolls.

(11) A laboratory fatigue test on a steel specimen includes two stages: a "crack-starting stage," followed by a "crack-spreading stage." Direct experimental evidence is available to show that the second stage may be a slow process, requiring over 20,000 stress cycles to accomplish. Again, broken rolls often show strongly heat-tinted hair cracks of apparently long standing. In the case of rolls, the slow crack-starting stage of the laboratory fatigue test is probably replaced in most cases by the sudden intrusion of some extraneous agency, such as too rapid cooling. Progressive fatigue failure by crack spreading then sets in, and may be quick or slow, according to the depth of the initial cracking.

(12) Mathematical analysis suggests that for a roll of diameter D, a certain depth, viz., 0.035 D, is critical, *i.e.*, a hair crack of less depth is not likely to spread, but a hair crack of greater initial depth will spread rapidly. It is thought to be highly significant that this critical depth is about the preferred depth of chill on new rolls, the presumption being that surface hair cracks naturally tend to extend down to the mottle following the natural planes of cleavage between the columnar chill crystals. When the mottle is reached, a higher resistance to further cracking is encountered, and will only be overcome if the mottle lies deeper below the surface than the critical depth.

(13) An exhaustive mathematical investigation of the stress ratios in revolving beams of lenticular section when compared with the hair-crack markings actually found on the fractured faces of broken rolls and shafts shows that hair cracks tend to terminate in elliptic curves of uniform crest stress ratio.

(14) Curves have been constructed which make it easy to evaluate stress ratios corresponding to the hair-crack markings on broken rolls. It is anticipated that by the time a fairly large number of actual roll breakages have been analysed by this method and classified according to stress ratio, valuable clues will be revealed as to why, how and when the cracks first originated, the quality of the roll, etc.

(15) The imperfect elasticity of cast iron is not sufficiently pronounced at stresses up to half its tenacity seriously to invalidate the ordinary equations of elastic bending; consequently such equations are admissible for calculating fatigue stresses.

(16) At stresses above half the tenacity, strain increases much more rapidly than stress, and the stress-strain curve in tension bends over much more than the stress-strain curve in compression. Hence the neutral axis drifts away to the compression side. Thus the distribution of stress assumed in the ordinary formulæ for elastic bending is widely departed from. The error introduced is not only large, but differs according to whether the section is round or rectangular, and will vary in both cases with the "sponginess" of the iron and the intensity of the stresses.

(17) The assumption that plane sections remain plane after bending remains approximately true for inelastic bending, and calculations based on this assumption still agree with experiment provided due attention is paid to the complications outlined in conclusion (16).

(18) The modulus of rupture for round test-bars varies between about 1.8 to 2.0, according to the equation:

$$m_r = 1.1u + 9.5 \text{ tons/in.}^2$$

(19) For cast irons of medium strength:

$$\frac{\text{Modulus of rupture on square bars}}{\text{Modulus of rupture on round bars}} = 0.89$$

approximately.

(20) For a given grey cast iron the strength falls off with increase of section, provided the smallest section included shows no signs of chill.

(21) On assumptions thought to be reasonable, it would appear that a 30-in. roll may be three times stronger, but will break under about half the deflection of a 20-in. roll.

(22) A sound roll with a deep chill should be stronger than a sound roll with a chill of usual depth. There would be little difference between them as regards breaking deflection. The danger of a deep chill lies in the greater liability of a surface hair crack to penetrate rapidly to a depth at which the residual strength is inadequate to carry the load.

(23) If a new roll is severely overloaded, it will break after making a few revolutions at a surface stress considerably below the static modulus of rupture. "Running modulus of rupture" is suggested as a suitable term for this stress.

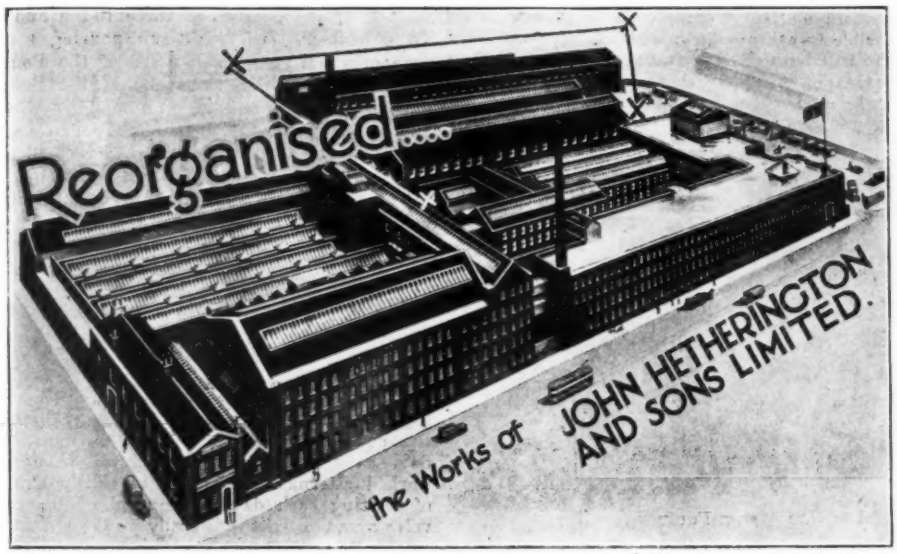
(24) Almost nothing appears to have been done to measure the fatigue limit and "running modulus of rupture" of chilled and mottled roll iron. Suitable experiments directed to this end could hardly fail to yield results of value.

British Cast Iron Research Association.

A private meeting of members of the British Cast Iron Research Association was held in Birmingham on December 9, followed by meetings in Sheffield, Newcastle, Leeds and Swansea. The meeting for members in the London area will be held on Friday, December 19, at the St. Pancras Hotel, at 3.30 p.m. This date has been chosen partly to meet the convenience of a number of members who will be going to London in any case for the annual dinner of the London Section of the Institute of British Foundrymen in the evening. Facilities for changing will be available at the hotel.

Members of the Association who may not have been able to attend the meeting in their own district are cordially invited to the London meeting. The remainder of this series will be held in Glasgow on December 22, Falkirk on December 23, concluding with a meeting in Manchester on January 6, 1931. The present series, it is understood, will deal with the new type of cupola known as the balanced-blast type and production of high-strength irons.

Sponge Iron in Germany.—According to a British official report from Berlin, work was continued on the sponge-iron method for the production of steel on which the Eisenschwamm G.m.b.H. at Bochum are engaged experimentally. Messrs. Friedr. Krupp A.G. have placed well-equipped laboratories at the disposal of the company for the purpose of analysing iron-ore samples. It is intended to take up regular output to the amount of between 25,000 and 30,000 tons in the autumn of 1930. In its present stage the process will not lead to a cheapening of steel production, but it furnishes a very pure and uniform high-quality scrap which proves to be an excellent raw material.



Reorganised Works of John Hetherington and Sons Limited.

By E. Longden.

An interesting and practical example of successful rationalisation is disclosed in the reorganised works of Messrs. John Hetherington & Sons, Limited, textile and machine-tool engineers, of Manchester. The changes were carried out under the direction of Mr. E. V. Haigh, C.B.E., M.I.Mech.E., chairman and managing director of the company.

The writer thanks Mr. Haigh and his co-directors for permission to write an account of the effect of the changes on the foundries and pattern shop.

It is within the writer's knowledge that, previous to the concentration of the works, castings were produced at a quite competitive figure. Rationalisation has resulted in a lowering of foundry prime costs by between 23 and 25 per cent. on the previous not-unsatisfactory figure. At the same time, there has been a considerable improvement in working conditions and earnings of the operatives.

Historical.

The origin of the company dates back to 1830, so that this year it attains its centenary. The founder of the company, Mr. John Hetherington, lived in an age when the utilisation of machinery to replace man-power was strenuously opposed by the workpeople, and in no case was this more evident than in the development of textile machinery. Mr. John Hetherington was closely associated with Sir William Fairbairn, and thus acquired an extensive experience in many branches of engineering, including the early experiments in the building of ships and the Lancashire boiler.

For many years the company has specialised in the production of textile machinery, and also machine tools, and during the last five years artificial silk machinery plant. That the firm is always in the forefront is shown by their enterprise in taking up and manufacturing so successfully artificial silk machinery, and at the same time completing an extensive rationalisation of the works and technical staff. A very fitting climax to complete a century of achievement.

The reorganised textile-engineering and machine-tool departments contain a working floor area of over 600,000 sq. ft., of which about 90,000 sq. ft. is occupied by the foundry and pattern-shop departments.

A view of the concentrated textile-machinery works is shown in the title block, the firm's adjacent machine-tool department not being seen on the photograph. The foundry group occupies the area enclosed by the lines XX. Prior to 1926 the company ran three separately-conducted foundries located at considerable distances from each other. All foundry work is now concentrated at the reorganised and extended foundries of the Vulcan Works. It is easy to understand that concentration of the activities of the various old works had been thought necessary for many years, but the magnitude of the task would create an atmosphere which would lend a willing ear to the word "inopportune." Therefore, considerable courage, energy and ability must have been exercised by those responsible for the changes. It is pleasing to record that in all the necessary moves the greatest consideration was given to its effect on the employees.

When reconstructing, care was taken to arrange for healthy working conditions for all concerned and to the transport of materials. Apart from sentimental reasons, congenial working conditions foster good work and a profitable return for outlay. And, since it is estimated that on an average 100 tons of material is handled in a foundry to produce 1 ton of castings, transport and handling must always be a worthy subject for study.

Transport and Handling of Materials.

Whilst the foundries are principally fashioned to produce 250 tons of repetition and semi-repetition castings per week, many types can be made up to 18 tons. The main moulding floors are served by four overhead electric travelling cranes and 15 special hand-operated trestle cranes. The novel advantages of the latter will be explained later.

Except for the heavy foundry area, the moulding floors are split up by metalled gangways carrying special guide rails along which run the 5- to 7-cwt. bogie ladles for distribution of molten metal to the light and medium moulds. Turntables are located where the lines intersect.

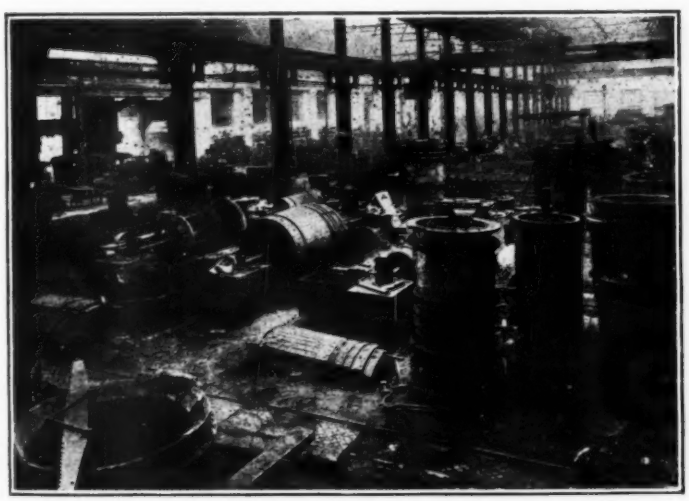


FIG. 1.—SHOWING VIEW FROM THE CYLINDER END OF THE MEDIUM AND HEAVY BAY. NOTE THE COLLAPSIBLE CORE BARRELS.

FIG. 2.—VIEW FROM THE MEDIUM-CASTING END AND GANGWAYS LEADING FROM THE CUPOLAS.

Fig. 1 shows a view from the cylinder end of the medium and heavy foundry. The collapsible cylinder core barrels will be noted in the foreground. Fig. 2 is taken from the medium casting end, and illustrates the lay-out of the gangways leading from one of the pairs of cupolas seen on the right. This is an early morning view, just before sweeping the gangways, etc., and Fig. 3 is of the medium jobbing floor.

The next photograph, Fig. 4, was taken in the new foundry, and illustrates the area about the base of two cupolas, and accommodation for

plate patterns which are constantly in use. Fig. 5 is of special interest, and shows a bay in the new foundry divided up into moulding floors of various sizes over which operate the trestle cranes previously referred to. Whilst the floors are plotted out to allow the moulding of specialities, it is quite practicable to produce castings of a jobbing nature.

Fig. 3.—Showing the Medium Jobbing End of the Foundry.

The moulding floors are flanked with plated gangways along which the metal bogies are operated, in some cases, to pour direct into the moulds; but generally the metal bogies are picked up by the trestle crane from the main gangway, which runs at right-angles to the working direction of the floors. The hand trestle cranes combined with plate patterns constitute a very serious rival to power moulding machines.

The next illustration (Fig. 6) depicts more clearly the construction of the cranes, and should be self-explanatory. The chains are quickly adjustable, to within very fine limits, either up or down and longitudinally. The chain pulleys can be freely moved lengthways. For medium castings it is possible to secure a pattern withdrawal equal to or superior to any power moulding machine. The impossibility of securing steady pattern withdrawals by an electric crane is notorious. Nor is there a large moulding machine yet on the market which can be said to give absolute satisfaction in this respect. There are, of course, many small types of power moulding machines which give entire satisfaction. Considering every lifting movement necessary to produce the casting from the plate pattern shown in Fig. 6, the trestle crane is the better machine tool. It is a quite inexpensive piece of plant. Again, consider that fifteen sets of men can be operating a crane at one and the same time. Similar service could not be performed by six or more electric cranes, even if it was found possible to operate them without clashing.

It will be noticed that the bay on the left, a portion of which is shown in Fig. 5, is only partly used. The complete scheme arranges for the use of a Sandslinger to operate in conjunction with the pattern plates and trestle cranes explained previously. Area has also been plotted out in the same bay to take a continuous moulding and casting unit.

Fig. 4.—Showing the Base of Two Cupolas and Pattern Storage.

Fig. 5.—Showing the Bay which utilises the Special Hand Cranes.

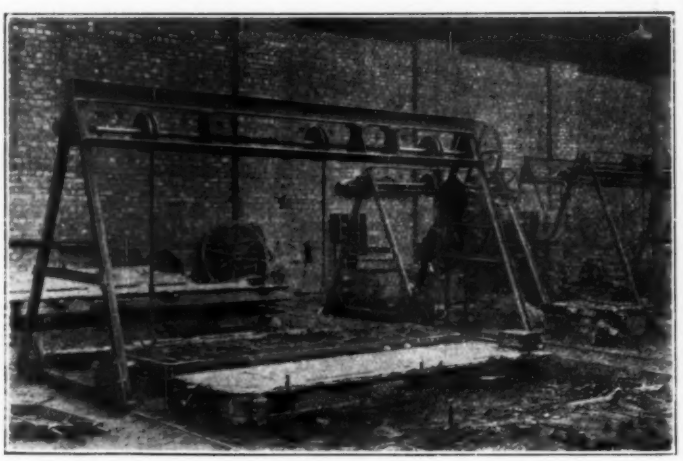


Fig. 6.—Showing Detailed Construction of the Special Hand-Operated Trestle Cranes.

Grey-Iron Melting Plant.

The melting plant is centrally located, giving quick delivery of molten metal to all parts of the foundries, and consists of three 10-ton and one 7-ton cupolas, each with two pouring spouts. Two of the 10-ton cupolas are of the Poumay design. Fig. 7 illustrates one of the Poumay cupolas in blast and also an adaptation of a tilting spout to give continuous pouring when operating the small bogie ladles—a very effective device which is fitted to all four cupolas.

The blowing arrangements are such as to ensure a continuity of melting when the blower has once been started and freedom from those very harassing and expensive stoppages which are far too common.

Three blowers are located on the middle floor under the cupola platform and linked up so that any blower can supply blast to any one of the four cupolas. The blowers are of the Roots Positive type, and capable of delivering 400,000 cub. ft. of air per hr. Generally, only two cupolas will be in blast on any particular day, as the cupolas are changed about and worked alternately to allow of timely starting of melting each day as required. By suitable valve arrangements it is easily possible to set the middle blower into operation should either of the two blowers fail in any respect during melting.

The cupolas are served by a charging platform 340 ft. long by 25 ft. wide. On this platform operates a 2-ton electric crane. The platform, in effect, takes the place of the usual ground-

floor stock yard and will hold metal and fuel stores up to 2,000 tons.

All incoming materials are delivered with a minimum of handling. Pig-iron is unloaded from the railway trucks directly on to special steel cradles located on the transport vehicle, each cradle holding 30 cwts. of pig-iron. On arrival at the foundry, the cupola-platform electric travelling crane is operated to lift the loaded cradles on to the charging platform. The pig-iron remains on the cradles until required for charging into the cupola, when it is weighed in bulk and corrected to 30 cwts., and placed near the loading door of the cupola for hand charging. The amount of pig-iron per charge is divided into 30 cwts., so that if 5 cwts. of a certain brand of pig-iron is necessary per charge, at the end of six charges the 30 cwts. will have been used. Fig. 8 shows a view of the charging platform with stocks rather low.

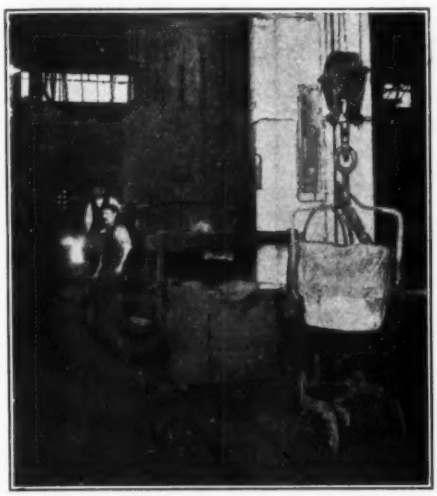


FIG. 7.—SHOWING ONE OF THE 10-TON POUMAY CUPOLAS IN BLAST. NOTE THE SPOUT ATTACHMENT FOR CONTINUOUS POURING.

FIG. 8.—GENERAL VIEW OF THE CUPOLA CHARGING AND STORAGE PLATFORM.

The platform holds reserves of metal, but the bulk of pig-iron is handled direct into the cupola, as previously stated, without having been unloaded from the cradles or carriers. The cradles are, therefore, constantly in motion from the works to railway trucks, thence to cupola platform in cycle. Both new scrap and foundry returns—headers, sprues, gates, etc.—are handled by special metal containers.

At the end of the daily melt the contents of the cupola—slag, coke, etc.—are allowed to fall into a steel container lined with black floor sand and placed under the drop bottom. The container is hauled from under the cupola by a pulley-block attachment leading through to the cupola-platform crane. This movement has the effect of breaking up the conglomerated mass which forms under the cupola.

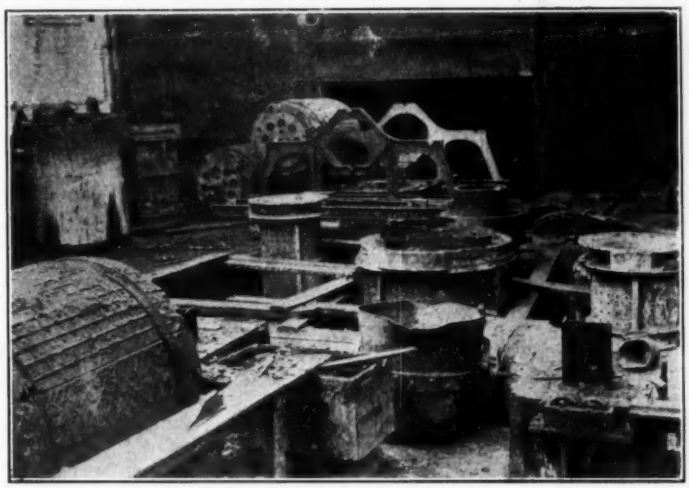


FIG. 9.—SHOWING THREE OF A BATTERY OF FOUR PLENUM (AUGUST'S MUFFLE FURNACES, LIMITED) MOULD-DRYING STOVES.

Moulding and Core-Making.

The repetition and semi-repetition castings are made from highly-finished pattern plates and moulding machines of various types. Medium and heavy castings are made in the usual manner in loam, dry sand and green sand by skilled moulders. Core-making is aided by the use of multiple core-boxes and rotary machines, etc.

Drying Stoves.

Four large and three small stoves, five of which are shown in Figs. 9 and 10, are employed to dry cores and moulds. Floor moulds are dried by patent oil-burning dryers. The stoves are constructed on the Plenum system by Messrs. August's Muffle Furnaces, Limited, of Halifax.

Sand-Mixing Department.

Two ordinary sand mills are operated, one to mix and mill green sand and the other to make loam and sands for cores and dry-sand moulds. The various ingredients are stored conveniently around the mills in special bins. After milling the sand, mixtures are fed into a Royer sand mixer, which is set to throw the material directly into stock bins or into containers for immediate despatch to the various sections of the foundry.

This plant is again simple and inexpensive, and it is possible to secure sufficient well-mixed materials for the production of approximately 250 tons of castings per week from the labour of two and a-half men.

Dressing Castings.

Large castings are fettled in the exit end of the heavy moulding bays, and small and medium castings are dressed in a long building running parallel to and between the foundry and casting stores. The dressing department is equipped with tumbling barrels, fixed and loose emery grinding machines, and a common dust-exhausting system linked up to the fixed grinding stones and tumbling barrels. There is a very short delivery for the castings to the store-rooms—a matter of only a few yards.

Softening of Grey-Iron Castings.

To facilitate high-speed machining a large number of small castings are annealed at a temperature of 825 to 875 deg. C. for periods of 6 to 7 hrs. Two large modern annealing ovens built by Messrs. August's Muffle Furnaces are illustrated in Fig. 11. There are also three smaller ovens of home-made design located in the same department and opposite the larger and newer type.

Welding and Straightening Department.

Quite a useful department has been developed to recover castings which have superficial defects. Great strides have been made in the welding of grey iron and other metals. It will be realised that there is a real problem in the distortion of some of the light textile-engineering castings of expansive area. Whilst for standard work the necessary camber combined with gating and metal temperature has been determined, there are always variations of an incalculable char-

FIG. 10.—SHOWING TWO OF THE THREE SMALL DRYING STOVES.

FIG. 11.—TWO LARGE MODERN ANNEALING OVENS BY AUGUST'S FOR USE ON GREY IRON.

acter cropping up either due to straining of moulds, amount of moisture in sand and variation in temperature of metal, etc., which will alter the distortion of the casting a little from the predetermined and calculated camber. It is to remedy the comparatively small proportion of castings not true to required outline that the straightening and stretching department is needed. It becomes quite a skilled job to be able to straighten castings.

Wood- and Metal-Pattern Shop.

The pattern shop pictured in Fig. 14 is located conveniently to the moulding departments. All small textile-machinery wood patterns are made in this department, but patterns for the larger and less handling loss. Stores for non-ferrous materials are located in the same department to reduce transport.

Pattern Storage.

One of the most difficult of changes made was that of pattern storage, identification and registration of something like 30,000 patterns which had been previously lodged in various places in the different works before concentration. The system in vogue at the main Vulcan Works was considered very satisfactory, and it was decided to extend it to the remainder of the patterns.

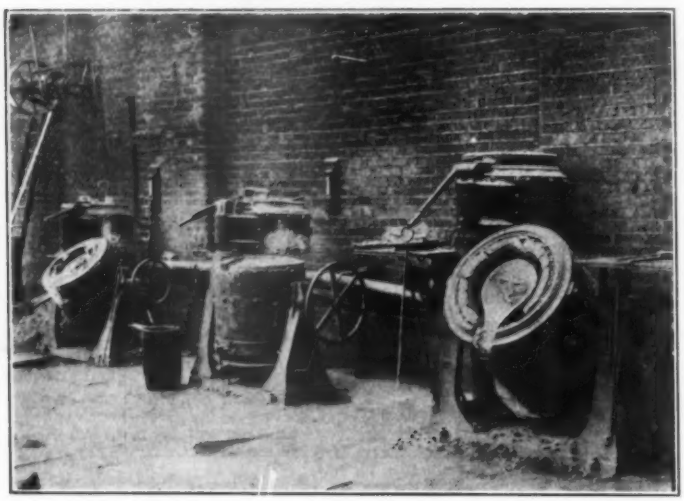


FIG. 12.—SHOWING THE MORGAN FORCED-DRAFT TILTING CRUCIBLE FURNACES INSTALLED IN THE BRASS FOUNDRY.

FIG. 13.—GENERAL VIEW OF THE BRASS FOUNDRY.

Non-Ferrous Castings.

Most non-ferrous alloys, including aluminium, are cast in the brass foundry. Moulds are made from special pattern plates and moulding machines. Loose patterns are used for castings of a non-repetition nature. Melting is carried out in Morgan forced-draft tilting crucible furnaces as illustrated in Fig. 12.

The castings are cleaned in the usual tumbling barrels and on emery grinding stones. Dressing arrangements, a portion of which can be seen in Fig. 13, have been made so as to isolate one alloy from another and reduce the danger of contamination of chippings, headers and gates, etc. This results in reduced expense of sorting and less handling loss.

machine-tool castings are made in another of the firm's departments near the machine-tool department. The metal patterns are constructed in the same department and, also, moulding boxes and foundry tackle fitted and repaired. All work carried out in this department is complementary, and great economy and advantages have accrued from the merging of the departments—small wood and metal patterns and fitting of moulding boxes, etc.

The metallurgical laboratory and foundry manager's offices are situated in an elevated position at one end of the pattern shop, with stores and pattern-shop foreman's office underneath.

A large number of patterns which are in constant use are stored in racks located underneath the cupola platform.

Class of Casting Made.

Figs. 15 and 16, if studied together with Figs. 1 and 9, will illustrate the practice for producing the carding-engine cylinders. Fig. 15 shows the completion of the pouring of a casting and the general arrangement of the top side of the collapsible core barrel.

It is interesting to record that Messrs. John Hetherington & Sons, Limited, were the first company to introduce the cast-iron cylinder for carding engines. To view, in the company's extensive show rooms, the first Arkwright carding

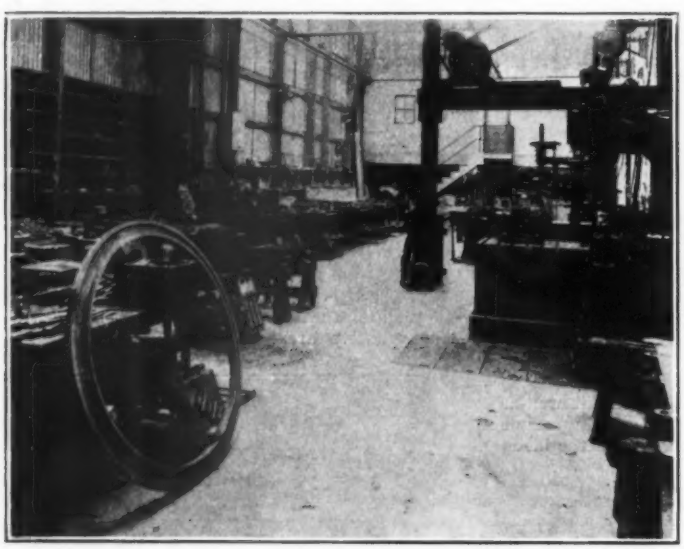


FIG. 14.—THE SMALL WOOD- AND METAL- PATTERN SHOP WITH THE TECHNICAL ADMINISTRATIVE OFFICES IN THE BACKGROUND.

FIG. 15.—POURING A CARDING-ENGINE CYLINDER.

engine with wooden cylinder alongside the present model is like comparing the old engine "Rocket" against a modern locomotive.

The cylinder castings are made with $\frac{5}{32}$ in. machining allowance and are required free from the smallest defect. The castings are top-poured. Fig. 16 shows a casting being lifted from the mould. Note how cleanly the casting strips.

FIG. 16.—STRIPPING A CARDING-ENGINE CYLINDER CASTING FROM THE MOULD.

The next illustration, Fig. 17, shows a woollen and worsted carding engine. It will be appreciated that the production of such castings is by no means simple, as a large external area is machined and polished. A highly-finished surface is necessary even on parts not performing any mechanical movement, because the "fly" from the material being treated in the machine would adhere too strongly to a rough surface. The art of designing runner gates and the quality and temperature of the metal plays the most important part in securing the excellent finish required on such castings.

There are more than fifty cylinders and rollers of various types and sizes on the machine shown,

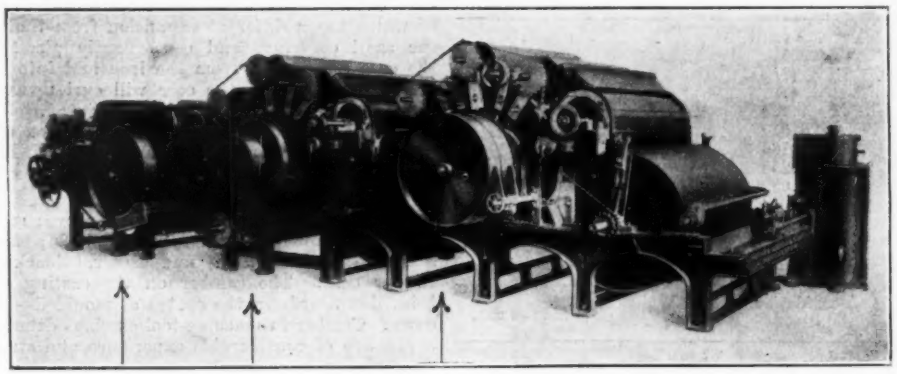


FIG. 17.—SHOWING A TYPICAL "HETHERINGTON" PRODUCTION—A WOOLLEN AND WORSTED CARDING ENGINE. IT IS AN AGGREGATION OF HIGHLY-FINISHED CASTINGS.

some of which after machining are barely $\frac{1}{8}$ in. thick. Cylinders from 24 in. up to 54 in. dia. are made as described for the cotton-carding engine. All larger sizes between 54 in. and 72 in., which are required not so frequently as the smaller size, are made in the ordinary way in loam. Rollers below 24 in. dia. are made on machines and pattern plates, moulded horizontally and turned up to be cast vertically. In every case the castings are top-poured through thin spray gates. Such castings are so thin compared with the surface area that other methods of pouring are not so successful. Any foreign matter finding its way into the mould will, but rarely, rise into the 2-in. scum head because of such thinness. Usually the scum will simply fold and stick to the mould or core surface and not rise with the metal.

The rollers above 6 in. dia. and cylinders are poured with a fairly close-grained iron of the following approximate composition: T.C., 3,25; Si, 2.00; Mn, 0.70; P, 0.80, and S, below 0.10 per cent. If the softer irons are used, dark open-grained patches become visible after machining. Of course, the above silicon content of 2 per cent. is as low as can be used for the thinner sectioned rollers. The largest cylinders are poured with silicon a little lower than the above—1.70 per cent. It is all a question of fluidity to pour the casting and machinability.

The pulleys indicated by the arrows are cast through thin spray gates arranged on the joint around the periphery and opposite the plate of the pulley. Here again extreme softness must be sacrificed to secure the necessary closeness of texture and finish. A metal with 2.25 per cent. silicon and the other elements as for rollers is suitable.

The castings marked "X" on the next illustration, Fig. 18, which pictures a number of ring frames in the showroom, are only glazed on the surfaces holding the markings "X." On machined surfaces there may be a chance of cleaning out a small surface defect, but not so with surfaces which are only glazed. Here again thin spray gates arranged over a large area and

FIG. 18.—THE RING-FRAME CASTINGS SHOWN CARRY HIGHLY-GLAZED AND POLISHED SURFACES.

poured with metal of moderate hardness are successful.

In a lecture to the Institute of British Foundrymen in 1929 the writer described the moulding of a jacketed cylinder for a pulping machine—a portion of the artificial-silk machinery plant.

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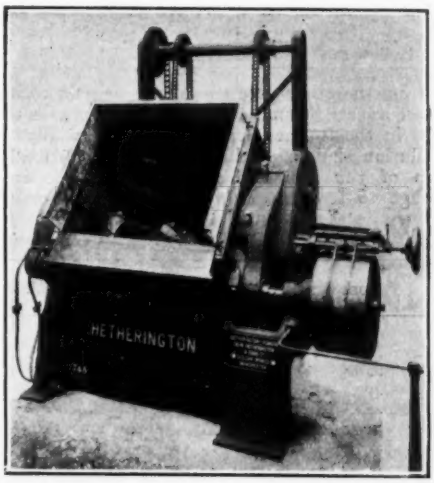

FIG. 19.—THIS IS NOT AN OIL-SAND MIXER, BUT A PULPING MACHINE FOR THE ARTIFICIAL SILK INDUSTRY.

FIG. 20.—ANOTHER TYPICAL HETHERINGTON PRODUCTION—A WHEEL-LATHE BEDPLATE WEIGHING 12 TONS.

Fuel Impregnation by the Slag in the Hearth and Bosh of the Blast Furnace.

By C. D. Abell.

It is undoubtedly true that the fuel in the hearth and bosh of the cold-blast furnace becomes impregnated by the slag, and the analyses shown in Table I are of interest in this respect. There are several types of impregnation products formed in this way, and they are briefly described as follow: The "amber slag," so called on account of its appearance and to distinguish it from the other products of the hearth, occurs as an interstitial mineral in association with the coke in the furnace hearth. It is essentially an oxidation slag, a product of the contact oxidation of the iron and manganese in the iron sponge to ferrous oxide and manganese oxide, identical with that of the mineralised fuel and may be considered to be of the same phase or type; it presumably occurs in the same part of the furnace or, in other words, at the same stage of the process. It crystallises in typical tetrahedra; it is translucent when crystallised and is obviously a definite physical and chemical entity and will be considered as such by the author unless proof to the contrary is forthcoming.

Table I.—*Impregnation Products of the Blast Furnace.*

Impregnation product.	"Amber slag."	Mineralised fuel.	Mineralised fuel.	Deoxidation slag.	"White slag."	Slag as run from the furnace.
Analysis.						
S	0.25	0.31	0.59	0.90	0.68	0.48
SiO_2	27.60	21.60	22.80	50.00	36.00	33.48
Fe	1.60	0.50	2.50	2.30	0.25	0.78
FeO	2.05	0.64	3.20	2.94	0.32	1.00
Mn	0.60	0.18	0.22	0.80	0.44	0.28
MnO	0.77	0.24	0.29	1.12	0.56	0.37
Al_2O_3	12.88	11.40	14.00	17.50	14.40	17.67
CaO	29.60	28.00	24.00	32.00	47.40	43.40
MgO	4.50	2.50	14.00	Trace	0.83	3.87
P	Nil	0.06	Nil	Nil	Nil	0.09
K_2O, Na_2O ..	ND	0.03	ND	ND	ND	0.05
C	22.35	35.22	21.12	Nil	Nil	Nil
Physical composition.						
CaS	0.56	0.69	1.34	2.03	1.53	1.08
FeO Al_2O_3 ..	3.87	1.54	7.74	7.11	0.77	2.42
MnO Al_2O_3 ..	1.86	0.54	0.69	2.71	1.36	0.89
MgO Al_2O_3 ..	13.23	8.87	12.58	Trace	2.95	13.73
Total spinels ..	18.95	11.01	21.02	9.82	5.08	17.05
CaO	29.16	27.45	22.96	30.42	46.21	42.56
Al_2O_3	—	3.77	—	11.74	10.35	5.86
MgO	0.79	—	10.47	—	—	—
SiO_2	27.60	21.60	22.80	50.00	36.00	33.48
Total silicates	57.55	52.83	56.23	92.16	92.25	81.89

The "mineralised fuel," occurring with the amber slag in the central zones of the furnace hearth, is essentially a silicified carbon, retaining the fuel ash in chemical combination. It still retains the structure of the coke from which it was formed. It is friable, with a distinct odour of acetylene, indicating the presence of carbides; it contains much free iron and crystalline graphite. It is quite possible that a considerable proportion of the limestone becomes converted to calcium carbide, or that other metallic carbides are formed.

Table II.—*The Iron Residues from the Mineralised Fuel.*

Constituents.	Tuyere metal.	Iron residue from mineralised fuel.	Pig-iron, as cast.
	Per cent.	Per cent.	Per cent.
T.C.	0.100	23.640	3.840
G.C.	None	(?)	3.210
C.C.	0.100	(?)	0.630
Si	0.580	7.420	0.770
Mn	Traces	0.510	0.520
S	0.090	0.180	0.052
P	Traces	0.250	0.340
T.C., Si	0.680	31.060	4.610
Temperature of slag	1,460° C.	1,460° C.	1,360° C. and 1,405° C.
Temperature of iron	1,460° C.	1,460° C.	1,240° C.

The Physical Composition of the Silicate Residues.

Phase.	"Amber slag."	Mineralised fuel.		Deoxidation slag.	"White slag."	Slag as run.
	Per cent.	Per cent.		Per cent.	Per cent.	Per cent.
CaO	50.66	52.00	40.84	33.00	50.10	51.96
Al_2O_3	—	7.10	—	18.75	10.87	7.10
MgO	1.37	—	18.62	—	—	—
SiO_2	47.95	40.90	40.55	54.25	39.25	40.33

as shown by the percentages of iron and manganese. It is generally friable and contains free iron in large globules and stringy veins. The similarity of composition when compared with the mineralised coke in respect to the percentages of sulphur, silica, lime and magnesia is noteworthy.

Apart from the percentages of oxygen, carbon, iron and manganese, the "amber slag" is

The "white slag" is essentially one obtained by the burning away of the mineralised fuel, and is distinguished by being low in iron and manganese content, but these figures are afterwards increased by the reactions in the furnace hearth during desulphurisation of the iron, as is illustrated by the total spinels present.

The facts revealed by these figures are interesting, and especially so the analysis of the amber slag, as it is of great use in understanding the reactions of the furnace hearth and of the different zones of the bosh.

Another aspect of the question is the composition of the iron residues obtained from these slags; the figures are given in Table II, and show a remarkable continuity of agreement with the analyses of the mineralised-fuel phases detailed. The silicate residues are also of peculiar interest in that they reflect the same consistency in their physical composition as the iron residues, and to a large extent show that the theory of the production of a definite chemical entity is essentially correct.

The Reorganised Works of John Hetherington & Sons, Limited.

(*Concluded from page* 409.)

shown in Fig. 19. This casting forms the most important part of the machine, and must withstand steam pressure—a different problem to that of the textile-machinery castings described.

The beaters shown on the inside of the cylinder are made of steel, although the writer is of opinion that a very strong cast iron of the same section would be quite suitable, as the resistance is only that of wood pulp. An iron of the following composition would stand all the strain and wear with safety: T.C., 3.20; Si, 1.00; Mn, 1.00; P, 0.20, and S, 0.15 per cent. The metal poured into the jacketed cylinder is of the following composition: T.C., 3.20; Si, 1.65 to 1.75; Mn, 0.80; P, 0.65, and S, below 0.13 per cent.

Fig. 20 shows the bedplate casting of a wheel lathe weighing 12 tons dressed. The casting was poured through twelve 1¼-in. by 3-in. runner gates marked "X" on the illustration. Six gates are located at each end, two on either side of the tee-head cores.

The tee-head cores prove troublesome to many founders and are very often omitted and machined out. The trouble arises from such cores twisting, breaking and fusing whilst the metal is still molten. This is due to the rapid expansion of the long, slender core, the iron of which has a different expansion from that of the sand covering, and consequently pieces of the core are pushed from the iron and into the metal. At the best the core will curl upwards at the ends where the cores are jointed. The trouble is avoided by making thin cast-iron core irons instead of the usual wrought irons, which are so apt to distort and break away a portion of the sand covering.

The following mixture of sands proves satisfactory for tee-head cores: red sand, 25; sharp sand, 25; ganister, 25, and mineral blacking, 25 per cent. The camber on the casting was ⅜ in. downwards in the centre as moulded—face down. Camber in machine-tool castings demands a practice of considerable experience and study. There is an astonishing lack of published data on the camber of castings, and the author proposes on some future occasion to deal fully with the practice and theory of camber in light and heavy castings.

Herr Ernst Kerl, a German steel expert, has, according to a message from Johannesburg, been appointed to assist in building the works of the South African Iron & Steel Industrial Corporation. When they have been completed, he will take charge of the smelting and rolling mills, and it is expected that he will eventually become general works manager.

High-Frequency Steel Furnaces.

An additional meeting of the Iron and Steel Institute was held jointly with the Sheffield Metallurgical Association at Sheffield recently, Prof. C. H. Desch in the chair, when MR. D. F. CAMPBELL gave a summary of his Paper on "High-Frequency Steel Furnaces," which had been read previously at the Autumn Meeting held at Prague on September 15 and 16 (see our issue for September 18). The following is an extract from the discussion.

MR. C. K. EVERITT said that, with regard to the figures given in the Paper, he was not quite clear whether those concerned the supply side or the furnace side of the motor generator, to which MR. CAMPBELL replied that it was the supply side.

Continuing, the speaker said he thought that was just as it should be, because the drawback to the furnace was the waste of current which took place in the motor generator. If the author could reduce that, then he (the speaker) thought it would be a definite advance. The ease of working was a great attraction; the absence of oppressive heat for the operators was of great advantage, and the economy in labour and in refractories made this furnace very attractive. He was quite sure that this furnace was only in its infancy, and that they might look forward to considerable improvement and progress, as they had seen had taken place even in the short time it had been in operation. He was sure they would all look forward to those improvements with great anticipation.

Question of Quality.

MR. H. ETCHELLS said that he thought these furnaces had one very great advantage in that they enabled one to employ what might almost be called unskilled labour. Of course, one required a very highly-trained metallurgist. Until now these furnaces appeared to have required pure base material to work upon, and that in itself was an item of expense in production. Compared with the crucible furnace, it was nothing new, but compared with the arc furnace it left something to the advantage of the arc furnace from the cost standpoint. He noted some remarks in the Paper to the effect that refining had been accomplished on the induction furnace, and he would be very interested if the author could give them some particulars of actual practice in that respect, because from the induction furnaces that the speaker had seen, it always appeared that the slag was much colder than the metal—in fact, so cold that it crusted over to a great extent—and he had always been of the opinion that to accomplish efficient de-sulphurisation and de-phosphorisation it was rather desirable to have the slag at a considerably higher temperature than the metal in order to maintain chemical activity.

Area of Bath.

Continuing, the speaker said that to maintain the most efficient electrical conditions in larger units it was necessary to have a compact mass in the bath. There was a definite relationship between the actual depth and diameter of the bath to get the best efficiency. For refining conditions they had always considered that the shallow furnace with a big slag area would lead to the most efficient refining performance. He wondered what would be the position in case there was a breakdown, and the steel had to be left in the furnace; whether, if it had stood in a solid mass, it could be remelted again; because this was a point that they sometimes had to consider in a steelworks. From the power standpoint, it seemed to him that the induction furnace was extraordinarily efficient, and, taken size for size, he thought its power consumption was really less on the whole than that of the arc furnace; and also there was the additional saving in electrodes. But one had to bear in mind the outlay on capital cost, and this was rather a difficult item to estimate with regard to production cost, because so much depended on the rate of production.

MR. L. F. KEELEY said that, regarding solidification of the charge, he had had occasion to remelt a charge after solidification, and had done so without any difficulty or detriment to the lining. With regard to the area of the slag, he thought possibly the small area of slag might be made up for by the rapid motion with which the metal was brought into contact with the slag, much more than in any other furnace. He would be interested to know more about the carbon-tungsten charge, because he assumed it would not melt by itself and would require a certain amount of cobalt, and he would like to know what was the minimum amount of cobalt that should be added.

Advantages of a Magnetic Shield.

MR. V. STOBIE said that his firm were convinced that high-frequency melting was the right thing. They designed a plant of 7 or 8 cwts. capacity, put that into action, and found exactly the advantages that Mr. Campbell had mentioned. They had got perhaps a little further. The method of building furnaces with a magnetic shield, though expensive, permitted of a strong construction, and there was an additional advantage in that, whatever happened in the furnace, there was an earth shield all round it, and it was perfectly safe for the men. He (the speaker) had been informed by a friend who was working one of Mr. Campbell's furnaces that he had noticed a reduction of the sulphur content in the steel—with an acid lining. That rather showed that the reaction wanted for refining could certainly take place.

DR. W. H. HATFIELD said that, whilst being heartily in favour of the high-frequency furnace, he entirely dissociated himself from any suggestion of using unskilled labour. He thought that Mr. Campbell would be well advised to confine the application of this type of furnace to the production of quality steels under good conditions.

Author's Reply.

MR. CAMPBELL said that Mr. Etchells had raised a question about refining, and Mr. Keeley had very largely answered it. He thought it might be said without any doubt that refining was due to two things—one was the hot slag and the other was bringing the metal into contact with that hot slag. With a high-frequency furnace the metal was certainly brought into contact with the slag hundreds of times faster than it was with any arc furnace or any Siemens furnace, and it was to this that he attributed the extraordinarily rapid refining that was obtainable with those furnaces. It was said that the slag was cold, but he thought they must bear in mind the temperature of the slag underneath. It was the contact of the steel with the slag that was under the surface that mattered. That slag surface was distinctly hot. The heat was brought with extraordinary rapidity from the middle or bottom of the bath into contact with the slag. So they had the hot slag surface, and the steel brought with great rapidity into contact with it. This overcame the difficulty of the shape of the bath. The author agreed with Dr. Hatfield that it was desirable to have skilled men on high-frequency furnaces, and he thought anybody that tried to use common labour for skilled work was looking for trouble. He would ask his audience to bear in mind there were problems that they had not got in Sheffield—problems of refining steel, and melting sponge iron. In Sweden, for instance, they were dealing with such a problem. They had practically no scrap available, and were expecting to fall back on sponge iron as their raw material to replace scrap steel. There was a great dearth of scrap in Sweden, and their problems there were different from the problems to be faced in Britain. The same applied to other countries. The control of casting temperature was also mentioned, and there was one aspect to which he would like to refer. With the induction furnace there was no flame or anything else to divert attention from the colour and the appearance of the steel, because the steel was the hottest part. With the arc furnace they had an intense heat, and they did not know the temperature; and they had flames in a Siemens furnace. But in this case they could see the steel, and there was nothing to divert their attention, as there was in the arc or the Siemens furnace. There was one other point—they could tell the number of calories that were being put into the furnace very accurately by watching the kilowatt meter, and, as the efficiency was very high, the chance of error was very small. They had repeatedly noticed that the increase of temperature in melting metals could be measured quite accurately—empirically—by watching the kilowatt meter

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Hints for Commercial Visitors to Egypt.—A pamphlet bearing this title has been published by the Department of Overseas Trade. It has been prepared from information supplied by the Commercial Secretary to the Residency, Egypt, and by the British Consular Officers at Alexandria and Port Said. Copies may be obtained from the Stationery Office, Adastral House, Kingsway, London, W.C.2.

Publications Received.

James Watt and Carron Company.—The Carron Company have issued the second brochure of a series dealing with famous men who, during their lifetime, were connected with Carron Works. The present number is devoted to an account of James Watt, whose investigations into the employment of steam gave the world its first steam engine. "Had it not been for the friendship and assistance given to him by Dr. Roebuck, one of the founders of the Carron Company, James Watt, mechanician, engineer and scientist, would probably never have completed his steam engine," states the pamphlet. Watt was born at Greenock on January 19, 1736. He was trained as a mathematical-instrument maker, and was recommended to Dr. Roebuck by Prof. Black, of Edinburgh, as the man who had been called upon to repair the working model of an early engine designed by Newcomen, the Devonshire inventor, for pumping water in mines, which was then in the possession of the University of Glasgow. In his early investigations into the employment of steam, Watt suffered much discouragement and disappointment, but under the guidance and with the financial assistance of Dr. Roebuck, who himself was an experienced mechanic and a man of science as well as being possessed of capital, Watt was enabled to carry through a long and costly series of experiments which ended in the production of the first complete steam engine. This took the form of a double-acting engine for winding coal and was erected in 1768 at the Burn Pit, near Bo'ness, belonging to Dr. Roebuck. Watt was also consulted by Dr. Roebuck on many points regarding the early machinery at the Carron Works. It is of interest to note that part of a cast-iron steam cylinder made at Carron in 1766 for Watt is still in existence at Carron. It can be seen prominently incorporated among the stonework of the great entrance gate at the works. A blowing engine, of the Watt type erected at Carron, remained in use until the works were reconstructed about 40 years ago. Unfortunately, owing to the size of this engine, which weighed some 300 to 400 tons, a proposal by the Carron Company to gift it to the nation could not be carried to fruition. Upon Dr. Roebuck becoming involved in financial difficulties, Watt proceeded to England, where later, in partnership with the great engineer Boulton, he was able to reap the full rewards of his genius. The modern industrial era may be said to date from the works of Watt, and with its commencement the story of Carron is closely associated. Watt died at Heathfield, in Staffordshire, on August 25, 1819.

For his contributions to the physical sciences Watt received great honours. He was elected a Fellow of the Royal Society in 1785, and in 1806 the University of Glasgow conferred upon him the degree of LL.D. His statue was erected in many towns. The term "horse power" was introduced by Watt, and his name is immortalised in the English language by the use of the words "Watt" and "Kilowatt" to denote units of electrical power.

Position of Trade and Industry in Glasgow and the West of Scotland.—An interesting brochure has been issued, by way of a Report, by the Glasgow Chamber of Commerce. The booklet extends to 26 pages and states that fragmentary as is the statistical material upon which it is based, it is yet sufficient to bring out the fact that as regards the basic industries—coal, iron, steel, shipbuilding and engineering—the West of Scotland, although making little actual progress since pre-war days, has, nevertheless, on the whole, maintained its position relative to other districts, and in some cases even improved upon it. The real difficulty under which the district labours is that, while it still has a considerable variety of industries, it depends mainly on those which are at the present time everywhere depressed.

XUM

Effect of Nitrogen on the Structure of Electric Welds.

At the Autumn Meeting of the Iron and Steel Institute, held at Prague on September 15 and 16, Prof. Henry Louis (President) in the chair, a Paper on "The Effect of Contamination by Nitrogen on the Structure of Electric Welds," was presented by Mr. L. W. Schuster, which concluded with the following general comments on results:—

In every instance where normalised samples showed needles, "as-received" samples if not already containing needles showed what approached a Widmanstätten structure, which was evidently the source of the needles. This structure was the same whether carbon was present or absent, and with normalised specimens was sometimes entirely replaced by needles, no trace of pearlite or braunite being visible—a statement which applies equally to all welds made in air or gases examined during the course of the investigation.

Of all the welds made with the special and the Swedish-iron electrode—with the exception of the first weld that was made in oxygen with the special electrode and into which appreciable nitrogen was discovered to have found its way—the welds made in nitrogen alone, when normalised, showed a pearlitic constituent. This undoubtedly was a nitrogenous body, and one capable of being broken up into needles when reduced by hydrogen.

It would be difficult to reconcile all the facts with the idea that oxygen is the source of any needles found, and that could only hold if oxygen were able to combine with iron and form a eutectoid similar to pearlite, capable of entering into solution at a temperature below 900 deg. C.

In considering the possibility of oxygen being the source of needles in welds it must be remembered that although considerable research has been carried out on the introduction of oxygen into steel, no authentic record can be traced that needles have been formed as a result.

Welds have been made in oxygen, which are quite free from needles, when a mild-steel, a Swedish-iron, and a special electrode were used. On every occasion where needles have been found it has definitely been determined that an appreciable amount of nitrogen was present.

In welds made in carbon dioxide no needles have been found. In every weld made in nitrogen needles have been present, either before or after heat treatment in an atmosphere free from oxygen. The examinations made yield no confirmation that gases other than nitrogen can form needles in welds. In every weld examined, where needles have been formed as a result of a normalising treatment, the "as-received" structure has shown what has been described for convenience as a Widmanstätten structure.

A cutting compound for hard metal can be made from ½ gill of castor oil, one tablespoonful of sulphur and one tablespoonful of mineral oil.

Lloyd's Register of Shipping Annual Report, 1929-30.—Lloyd's Register of Shipping (71, Fenchurch Street, London, E.C.3) have now published a Report of the Society's Operations during the year 1929-1930. According to this the chain cable tested during the year, under the Anchors and Chain Cables Act, 1899, at the eight public proving houses in Great Britain, amounted to 277,016 fathoms, weighing 19,794 tons. In addition, a quantity of miscellaneous chains and samples was also tested. The total number of anchors tested was 5,207, with a gross weight of 6,655 tons. At proving establishments abroad, the Society's surveyors have tested 68,945 fathoms of chain cable of 4,823 tons weight, and 2,218 anchors of 3,190 tons. The weight of ship steel and boiler steel tested during the year was 824,453 tons in this country and 435,025 tons abroad. The total amount, 1,259,478 tons of tested material, is over 200,000 tons in excess of last year's figure.

Catalogues Received.

Road Studs.—Messrs. Daniel Doncaster & Sons, Limited, of Penistone Road, Sheffield—a branch of United Steel Companies, Limited—have sent us a folder describing a complete line of forged rustless-steel road studs. This illustrates still one more important type of article which is making serious competition with cast products.

Sand-Milling Machines.—We have received from the Universal System of Machine Moulding & Machinery Company, Limited, of 13-15, Wilson Street, London, E.C.2, a four-page leaflet which describes and illustrates their latest type of sand-milling machines. In one, to stress that the grain of the sand is not broken, the firm has used the phrase "sand-rubbing." The machine illustrated (Type BMC 240) weighs 7 tons; has a pan, or rather plate, diameter of 7 ft. 10 in., and produces 15 to 17 tons of sand per hour.

Valves.—In connection with the recent visit of the West Yorkshire Branch of the Institute of British Foundrymen to the works of Messrs. J. Blakeborough & Sons, Limited, of Brighouse, we have received some of the trade literature. Amongst these is a 74-page catalogue which is a veritable text-book on the subject of valves as applied to waterworks problems. This foundry, at least, is to the forefront in its publicity matter. Folders, also to hand, outline in vivid colour some lines of fire extinguishers. These are of two main types—the "Nuswift Foam Type" and the "Nuswift Soda-Acid Fire Fighter."

Automatic Regulators.—Foundries do so many different things for a living that it cannot even be said that they all require temperature regulators for core stoves, but it can be postulated that either in the manufacturing processes or finished products, the majority require some sort of automatic regulator somewhere, and we thus specially recommend our readers to avail themselves of the offer of The Drayton Regulator & Instrument Company, of West Drayton, Middlesex, to send a copy of their latest 16-page catalogue, wherein are depicted regulators for a large number of uses—temperature, water level, CO-CO_2 recorders, pressure, humidity and so on.

Cylinder Irons.—The Workington Iron & Steel Company (Branch of the United Steel Companies, Limited), Moss Bay, Workington, Cumberland, have prepared an eight-page booklet describing their "U C O" pig-irons. These are all-mine irons, available in low percentages of total carbon. They are supplied to analysis, either the buyer's specification or an analysis is supplied with each consignment. A further feature of these irons is that they place their laboratory and research resources at the disposal of the buyer. The pamphlet is interleaved with squared paper, in order, we presume, to make provision for calculating mixtures, whilst the subject of pig-iron is uppermost in one's mind.

Flexible-Drive Tools.—Messrs. F. Gilman (B.S.T.), Limited, 221, High Street, Smethwick, Staffs, have sent us a folder which illustrates, describes and prices a series of British-made tools carrying the trade name of "Multi-flex." We notice a particularly interesting set of tools made up for garage work—and what foundry to-day does not possess one? As so many of these tools are of use in the cleaning shop, we suggest that a set of tools ought to be specially designed for the fettler—a series of wire brushes, grinders for both internal and external flash, rasps and files—whilst another set could be got together for the pattern shop. Many patterns are too large to be taken to the machine, and portable tools have to be used. We understand, from a covering letter, that some of the newer tools will be shown for the first time at the British Industries Fair next February. We have a good deal of faith in the increased application of power-driven small tools in the foundry industry.

Position of the Electrical Industry.

The annual dinner of the British Electrical and Allied Manufacturers' Association was held at the Connaught Rooms in London on November 18, Lord Derby (President of the Association) presiding. Those present included Sir Hugo Hirst (chairman of the General Electric Company, Limited), Mr. Winston Churchill, M.P., Sir E. Hilton-Young, M.P., Mr. Herbert Morrison, M.P. (Minister of Transport) and Mr. V. Watlington (chairman of the Council of the Association). The toast of "The Electrical Industry and Industrial Co-operation Within the Empire" was proposed by Sir Hugo Hirst, who, in the course of his remarks, said that at the conclusion of the war he had thrown out a suggestion that, just as the steam engine had come to the rescue of the country after the Napoleonic campaigns, so the electrical unit would aid the country and the Empire to recover from the exhaustion of a world war. At the time (he said) such a parallel might have seemed too visionary to be realised, but he thought it would be more acceptable to-day. It was true to the extent that the fullest use of electric power was now regarded as essential to efficient production. It was true also to the extent that the older industries—such as iron and steel, shipbuilding and textiles—underwent a process of rejuvenation when electrified. The use of power—and electric power in particular—was, in fact, an index to industrial efficiency. Next to creating higher efficiency in all our industries, the mobility of electric power was a factor which would have great influence on the re-shaping of our industrial life. Referring to the question of our unprotected markets, Sir Hugo said that, whilst the Central Electricity Board loyally spent the £34 million granted by Parliament with British producers, the foreign producer was beginning to enjoy the principal benefit of the "grid scheme." It would lead too far to give the reasons why this should be so, but he would like to say in one sentence: one could not start new industries bearing in mind the capital expenditure, the lay-out of works, the training of labour new to the work, and compete at the beginning with countries who, for reasons beyond our control, had arrived already at a mass-production state. We were being flooded with products of cheap labour. It did seem ludicrous that, when, by State action, by our capital, by our manufacturing enterprises, we were creating a rich and expanding market, we let it be exploited by competitors who shut us out completely from their own markets. If this flow of foreign electrical goods remained unchecked for long, Sir Hugo added, it could not help but affect the stability of the electrical industry.

Transformation of Austenite at Constant Subcritical Temperatures.—Messrs. E. S. Davenport and E. C. Bain, in Technical Publication No. 348, issued by the American Institute of Mining and Electrical Engineers, deal with certain characteristics of the austenite transformation in steels first heated to form a complete austenite solid solution and subsequently cooled rapidly to various subcritical temperatures permitting transformation. The characteristics investigated are: (1) The velocities of transformation at various constant temperatures. (2) The hardness of the products of transformation resulting at various constant temperatures. (3) The structures resulting from the transformation being forced to occur at various constant temperatures. (4) The influence of carbon (and other elements) on the characteristics mentioned above. In general it has been found that transformation is slow immediately below the eutectoid temperature, very rapid a few hundred degrees lower, and very slow for most ordinary steels between 150 deg. and 290 deg. C. The reaction is again rapid at still lower temperatures. High-alloy steels show the same characteristic velocity changes at somewhat different temperatures. The great variation in time involved in the transformation at various temperatures necessitated the use of a logarithmic time scale in plotting the duration of the reactions. The hardness of the product decreases with increase in the temperatures at which the transformation occurs. The hardness varies, not in a linear fashion, but in a characteristic manner. The structures are arbitrarily designated by five typical microscopic appearances. The names applied to the structures are in no wise to be regarded as significant of anything novel other than convenience. The authors have named them: A, coarse pearlite; B, fine pearlite (often classed as nodular troostite); C, troostite; D, martensite-troostite, and E, martensite.

XUM

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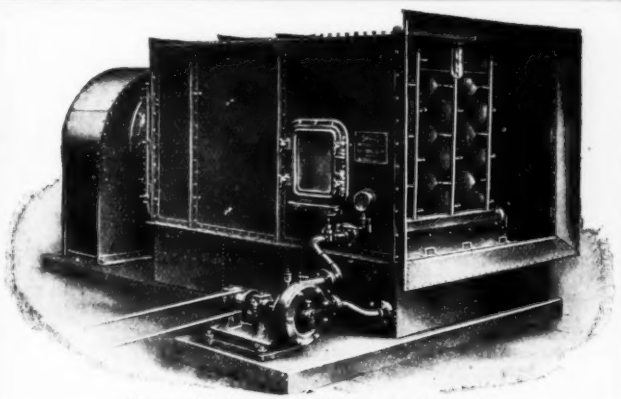

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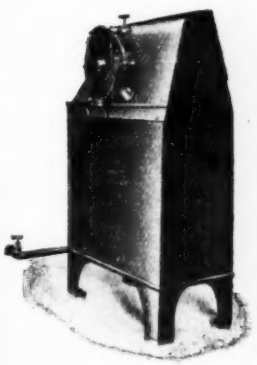

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Trade Talk.

The Atlas Preservative Company, Limited, have removed from Windmill Lane Wharf, Deptford, to Fraser Road, Erith, Kent.

An application for permission to change the name of the Surveyors' Institution to "The Chartered Surveyors' Institution" has been approved by the Privy Council.

On Monday, December 1, Mr. G. Glenn, of Sheffield, read a Paper on "Effects of Impurities in Plain Carbon Steels" before the Cleveland Institution of Engineers at Middlesbrough.

The Great Western Railway Company has placed an order with Messrs. Earl's Shipbuilding & Engineering Company, Limited, Hull, for the construction of a new twin-screw passenger tender.

The English Electric Company, Limited, have received a contract from the Leyton Borough Council for 50 double-deck tramcar bodies. Structurally the bodies are of metal design. The value of the order is approximately £90,000.

Employees of the following firms have made contributions to West of Scotland Charitable Institutions:—Argus Foundry Company, Limited, Thornliebank, £79; and Messrs. Kerr & Company, Limited, Caledonia Foundry, Maryhill, £55.

British Insulated Cables, Limited, and Callender's Cable & Construction Company, Limited, have acquired an interest in Messrs. Thomas Bolton & Sons, Limited, Mersey Copper Works, Widnes, including representation on the board of directors.

The London & North Eastern Railway Company has accepted a tender from Messrs. Sir Robert McAlpine & Sons of £92,926 for the construction of a bridge to carry the main line over the north circular road at Bounds Green Road, New Southgate.

Messrs. August's Muffle Furnaces, Limited, of Thorn Tree Works, Exmoor Street, Halifax, have just delivered four of the No. 2 size Simpson mixers to Messrs. Crane-Bennett for their new foundry at Ipswich. They already have two No. 2 Simpson mixers installed, thus making a total of six.

Two hundred gallons of petrol made an exciting blaze in the Elmbank Foundry of Messrs. James Allen, sen., & Sons, Limited, Possil Park, Glasgow. The office and part of the foundry were damaged before the firemen could subdue the flames, which were 40 ft. high. It is understood that the work of the foundry will not be seriously interfered with.

Messrs. Ruston & Hornsby, Limited, Lincoln, wish to state that, notwithstanding previous announcements by the manufacturers of the Rushton tractor and themselves, they find that the impression exists that "Rushton" is associated with the name Ruston & Hornsby, Limited, particularly in some overseas countries where the term tractor may be used to denote an internal-combustion engine. Messrs. Ruston & Hornsby, Limited, are not the makers of the Rushton tractor, nor are they associated with the company manufacturing this tractor.

Mr. S. G. Bron, trade representative of the Soviet in Great Britain, and Mr. Sam Mavor, chairman of Messrs. Mavor & Coulson, Limited, Glasgow, have issued the following statement:—We have signed an agreement which provides for the placing by Messrs. Arcos, Limited, as agents for the trade delegation of the U.S.S.R. in Great Britain, of orders for different kinds of coal-cutters and spares to the amount of £160,000 during the next twelve months. Satisfactory credit terms have been arranged.

An amalgamation is proposed between Messrs. Allen-Liversidge, Limited, and the British Oxygen Company, Limited. At an informal meeting of the shareholders of the former company, held in London recently, the details of the proposed merger were discussed. Mr. Harry Stevenson, the chairman, who presided, emphasised the advantages of the proposed fusion, and pointed out that, in addition to oxygen, the British Oxygen Company were also manufacturers of other gases of industrial importance, including hydrogen, carbon dioxide, nitrogen, nitrous oxide, argon and helium

The fact that a systematic training for foremanship was so difficult to find in this country was deplored by Mr. Kenneth M. Sloan in the first of a series of lectures under the Loudon Lectureship in Engineering Production, which he delivered in the Glasgow University. He suggested that this defect should be remedied without delay, either by groups of employers themselves or by the State. If groups of employers combined in the interests of research work for advertising and so on, why not for the training of the foreman, upon whom so much of our national prosperity depended? Mr. Sloan compared modern ideas with those of the past, and showed how new methods of manufacture affected training.

Further to our note on the equipment of the new foundry of the Austin Motor Company, Limited, the Constructional Engineering Company, Limited, of Titan Works, Charles Henry Street, Birmingham, inform us that they have secured the order for the melting plant and are installing Poumay cupolas. At the Crane-Bennett foundry, at Ipswich, they have installed one 90-in. and one 60-in. cupola, also of the Poumay type. Other recent orders include a complete melting equipment for Messrs. G. & J. Weir, Limited, Cathcart, comprising two 8-ton Poumay cupolas, with fans and motors, charging platform, charging crane, etc. In all the above plants the cupolas are being mechanically charged.

Messrs. Thos. W. Ward, Limited, of Sheffield, have acquired the works of the Carnforth Hematite Iron Company, Limited, Lancs. This West-Coast hematite concern, which had a capital of £144,000 and was established in 1865, is by no means obsolete, and would not have come on the market but for the depressed condition of the iron and steel trades. The purchase includes the blast furnaces and plant, limestone quarries and works site, which is freehold, with eight miles of railway, but is exclusive of the houses and cottages. The site is an important one, situated on the L.M. & S. main line to Scotland, and the offices are about 100 yards from Carnforth Station. The three blast furnaces had a weekly capacity of over 4,000 tons of high-class hematite pig-iron, and the quality of the limestone quarried was unrivalled for blast furnace use. It is probable that the fate of the works will depend on the result of future developments towards safeguarding.

Company Meeting.

British Aluminium Company, Limited.—Meetings of the holders of preference shares and ordinary shares in the British Aluminium Company, Limited, and also an extraordinary general meeting of the company were held recently in London, to consider resolutions modifying the rights of the preference shareholders, adopting revised articles of association, and increasing the capital of the company from £1,500,000 to £2,400,000 by the creation of 900,000 6 per cent. preference shares of £1 each. Lieutenant-Colonel S. H. Pollen (chairman), addressing the preference shareholders, said that the first stage of the large hydro-electric installation and aluminium works at Lochaber, in Inverness-shire, had been completed and had been in satisfactory operation since the beginning of the year. The directors considered it desirable that the final stages should now be completed, seeing that by a considerably smaller expenditure, compared with the initial outlay, the company would possess an installation providing about three times the present available power. To carry out this plan it was necessary to raise further capital. It was proposed to clear the ground by the redemption of the existing prior lien debentures and debenture stock. Further, in order to bring the share capital of the company into a closer relation to its assets, which had increased from £2,558,201 in 1910 to £5,518,266 at the end of 1929, they proposed to create 900,000 preference shares, bringing the total up to 1,200,000, which was the same as the authorised ordinary share capital. They also proposed to create £5,000,000 first mortgage debentures and to issue in the near future one-half of that amount, redeeming the existing debentures out of the proceeds of these issues. The resolution was unanimously approved. The meeting of ordinary shareholders approved the proposals, and assent was also given at an extraordinary general meeting of the company.

Reports and Dividends.

Renold & Coventry Chain Company, Limited.—Interim dividend of 5 per cent. actual.

Blaenavon Company, Limited.—Profit, after providing for debenture stock interest, of £18,154, reducing the debit balance brought in to £88,511.

Broughton Copper Company, Limited.—The directors do not recommend the payment of the dividend on the preference shares for the half-year to December 1.

Personal.

Mr. Wesley Lambert, Past-President of the Institute of British Foundrymen, read a Paper entitled "Non-Ferrous Engineering Alloys" at a joint meeting of the Institution of Engineers and Shipbuilders in Scotland and the Scottish Section of the Institute of Metals on December 2.

Mr. and Mrs. William Welsh Ferguson, of Falkirk, celebrated their golden wedding on December 3. Mr. Ferguson, a moulder, was in the employ of the Falkirk Iron Company, Limited, for 59 years, and, when he retired about five years ago, he was presented with a gold watch by the firm.

Wills.

Pitman, Major H. E., a partner in Messrs. Wilcox & Pitman, of Paragon Works, Henrietta Street, Birmingham, brassfounders £23,101

Contracts Open.

Edinburgh, December 15.—422 grates, for the Town Council. Mr. E. J. MacRae, city architect, City Chambers.

Livingstone, January 6.—Steam-driven pump, piping and fittings, for the Municipality of Livingstone, Northern Rhodesia. The Department of Overseas Trade. (Reference A.X. 10,585.)

Nottingham, December 15.—Cast-iron pipes, wrought iron and steel, and small iron castings, for the Gas Committee. The Engineer and General Manager, Gas Offices, 6, George Street, Nottingham.

Rainham, Essex.—Electric motors and pumps, for the Dagenham Urban District Council. Mr. T. P. Francis, engineer and surveyor, Council Offices, Becontree Avenue, Chadwell Heath, Essex.

Stockport, December 16.—2,500 tons of cast-iron pipes and special castings, for the Corporation. Messrs. G. H. Hill & Sons, civil engineers, 40, Kennedy Street, Manchester. (Fee £1 1s., returnable.)

New Companies.

Marcus H. Hodges & Sons (Engineers), Limited, City Basin Ironworks, Haven Road, Exeter.—Capital £10,000. Directors: M. H. Hodges, W. B. H. Hodges and A. J. M. Hodges.

Smith, Bayliss & Nettlefold, Limited, Charles Street, Walsall, Stafford.—Capital £10,000 in £1 shares. Stainless steel makers, etc. Directors: T. A. Smith, F. Bayliss, Lucy F. Nettlefold, H. Nettlefold and G. S. Bayliss. Secretary: E. W. King.

J. & H. M. Jenks, Limited, Heath Town, Wolverhampton.—Capital £3,500. Iron and steel merchants, etc. Directors: H. M. Jenks, Jane P. L. Jenks, S. Hartland and W. A. Bennett. Secretary: S. Hartland.

Patent Specifications Accepted.

The following list of Patent Specifications accepted has been taken from the "Illustrated Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each. The last numbers given are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

18,518. United States Cast Iron Pipe & Foundry Company. Method and apparatus for changing the form and improving the texture of hollow metal articles. 334,634.

20,730. Aluminium, Limited. Aluminium base alloys. 334,656.

27,764. Metal Castings, Limited, and Nicholson, A. H. Casting of metals or alloys. 334,714.

33,823. Schmidt Ges., K. Aluminium alloys. 334,777.

625. Wacker Ges. für Elektro-Chemische Industrie Ges., Dr. A. Manufacture of aluminium alcoholates containing aluminium chloride. 334,820.

12,825. Smallwood, A., and Fallon, J. Furnaces and/or apparatus for the annealing or heat-treatment of metal and other goods. 334,965.

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Sir Robert Hadfield's advice!

Speaking to the Colonial Premiers and others when they visited Hadfield's Steel Foundry on November 7th, Sir Robert said:

"I appeal to all present to support British manufacturers in every possible way . . . . . We can do a great deal amongst ourselves by mutual help and co-operation. British Steelmakers can give you the best steel for every purpose, and in these days it pays to use none but the best.

What is true of the steel industry is equally true of other industries in this country, BEFORE YOU BUY FOREIGN PRODUCTS OR PLACE ORDERS ABROAD—MAKE SURE YOU CANNOT OBTAIN AT LEAST AS HIGH QUALITY AND GOOD VALUE IN THIS COUNTRY."

WILL YOU DO AS SIR ROBERT SAYS?

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Iron and Steel Markets.

Pig-Iron.

MIDDLESBROUGH.—With the near approach of the Christmas holidays, business in the Cleveland iron trade is naturally narrowed down to minimum proportions, and at the close of an exceptionally lean year the position, although far from hopeless, is by no means promising of an early recovery. Already the steady advance in Continental quotations is diverting to this country orders which at lower prices might have gone abroad, and there has been a sharp decline in imports of foreign material. Continental iron is still in a strong competitive position in neutral markets, but in this country the margin between British and foreign pig-iron prices has been narrowed. Ironmasters here are hoping that a buying movement will not be much longer delayed, as a good many of their contracts expire at the end of the month and renewals are urgently needed to ensure continuity of operations. For the present, sales of Cleveland foundry iron are chiefly of a hand-to-mouth character, and no real attempt has been made to cover industrial requirements beyond the end of the year. Current quotations remain as follow:—No. 1 Cleveland foundry iron, 66s. per ton; No. 3 G.M.B., 63s. 6d.; No. 4 foundry, 62s. 6d.; No. 4 forge, 62s. per ton.

Conditions in the market for East Coast hematite are reported to be slightly improved on the export side, some fairly good orders having been recently booked for Continental consumers. Prices keep fairly steady, but they are not rigid, and sellers are prepared to shade quotations where attractive orders are at stake. Current quotations are in the vicinity of 70s. 6d. per ton for prompt deliveries of East Coast mixed numbers and 71s. for the first quarter of next year. On the North-West Coast, Bessemer mixed numbers are quoted at 70s. per ton, at works.

LANCASHIRE.—Reports from local markets for foundry pig in this area disclose a rather better tendency on the part of consumers to take advantage of the lower prices now ruling by enlarging their forward commitments to some extent, though hardly sufficient to indicate a more active demand. Prices, it need hardly be added, remain undisturbed, Staffordshire and Derbyshire No. 3 quality being quoted on the fixed basis of 69s. 6d., with Northants at 68s. and Scottish brands about 91s. per ton, delivered local stations.

THE MIDLANDS.—In the South Staffordshire and adjacent districts orders for foundry pig in small quantities are coming through at a better rate, and the situation is happier now than it has been for a considerable time, although even at this juncture the demand does not equal the output and stocks are accumulating. The following continue as the basis of official quotations:—67s. 6d. for Northants No. 3 and 71s. for North Staffordshire and Derbyshire No. 3, with Scotch brands 91s. to 95s., all per ton delivered local works.

SCOTLAND.—In the market for Scotch pig-iron business remains quiet, but prices are still maintained by the iron masters for No. 3 quality at 76s 6d. per ton at furnaces.

Finished Iron.

In the Black Country area there is no improvement in connection with business for iron bars. The makers of crown and the cheaper grades of iron are still passing through a very depressing period, and, unfortunately, it is not possible to see any brighter outlook in the immediate future. Only spasmodic working is possible, and the orders now being received from stock warehouses and consumers are of a very miscellaneous character. The Midland makers quote for crown iron anything from £9 15s. to £10 5s., but £9 10s. is being quoted for crown bars by works outside the Staffordshire district. Nut and bolt bars are offered at £8 15s. to £9, but little support is forthcoming, as the consumers of this grade of iron usually go to the Continent for supplies, where the present quotations for No. 3 grade from Belgian and French sources range from £5 7s. 6d. to £5 12s. 6d. delivered local works. The makers of Staffordshire marked bars, not having to bear the brunt of foreign competition, continue to be fairly well engaged, and their mills are moderately occupied. Their price is unchanged at £12 10s. at works.

Steel.

At Sheffield there is little change in the steel market, and the present quietude is expected to continue for the remainder of the year. Both acid and basic steel billets are in a depressed state, and makers of wire rods continue to experience sharp rivalry from the Continent, although this is a little less severe than of late. Prices have not altered this week. The production of open-hearth steel in this district has not dwindled further, but output is very small compared with a year ago. Stainless-steel production continues to expand, and output is probably of record proportions. Makers of high-speed steel are also well placed. The tinplate market continues to be quiet, with quotations ruling for coke quality at 15s. 9d. to 16s. f.o.b. Welsh ports.

Scrap.

Corresponding in conditions with other markets for foundry trade material, business moving in scrap is reduced to minimum volume, and on Tees-side good ordinary cast-iron scrap is now quoted at 50s., with machinery quality 52s. 6d. per ton. In Birmingham, although cast iron is rather better placed than some of the other qualities of scrap, the supply exceeds the demand. For heavy machinery cast iron in 1-cwt. pieces, 57s. 6d. to 60s. delivered is offered by local founders, and for ordinary heavy metal 52s. 6d. to 55s. Light cast iron is difficult to place at 37s. 6d. f.o.r., or 40s. delivered. In Scotland prices in the cast-iron scrap market are somewhat easier, there being very few outlets for any quality of this scrap. First-class machinery cast iron, suitable for foundries, is quoted at 57s. 6d. to 58s. 6d., ordinary cast-iron scrap to the same specification 52s. 6d., cast-iron railway chairs 56s. 3d. to 57s. 6d., light metal 41s. 3d. to 42s. 6d., with furnace firebars 40s. to 41s. 3d. The above prices are all per ton delivered f.o.t. consumers' works.

Metals.

Copper.—The recent upward tendency of warrant copper values was temporarily disturbed for a day or so last week, but later rallied, closing about £1 to the good. The latter improvement may be ascribed to a firmer tone observable in the United States, customs smelters holding for 11½ cents, although nothing was available for export at that price, and recently Germany, besides buying a moderate tonnage from the Exporters, has paid to outsiders a price only just below 12.30 cents. For the moment it looks as though the Association will be able to maintain its ring price.

Closing quotations :—

Cash.—Thursday, £48 17s. 6d. to £49; Friday, £48 to £48 2s. 6d.; Monday, £47 6s. 3d. to £47 7s. 6d.; Tuesday, £46 15s. to £46 16s. 3d.; Wednesday, £46 12s. 6d. to £46 13s. 9d.

Three Months.—Thursday, £48 16s. 3d. to £48 17s. 6d.; Friday, £48 to £48 2s. 6d.; Monday, £47 6s. 3d. to £47 7s. 6d.; Tuesday, £46 15s. to £46 16s. 3d.; Wednesday, £46 7s. 6d. to £46 10s.

Tin.—Although consumptive demand in the market for standard tin has hardly realised expectations, the tendency has been fairly firm, with price fluctuations confined within comparatively reasonable limits. The November statistics disclosed an increase in visible supplies of some 1,200 tons, offset, however, by a decrease in the Straits carry-over of about 600 tons. U.S.A. deliveries were reported at 6,300 tons, compared with about 7,600 tons in the previous month. As was expected, warehouse stocks of tin in this country were reduced by nearly 1,500 tons, the total at November 30 being 22,354 tons.

Official closing prices :—

Cash.—Thursday, £112 15s. to £112 17s. 6d.; Friday, £113 to £113 2s. 6d.; Monday, £112 5s. to £112 7s. 6d.; Tuesday, £111 12s. 6d. to £111 15s.; Wednesday, £111 12s. 6d. to £111 15s.

Three Months.—Thursday, £114 2s. 6d. to £114 5s.; Friday, £114 5s. to £114 7s. 6d.; Monday, £113 10s. to £113 12s. 6d.; Tuesday, £112 17s. 6d. to £113; Wednesday, £113 to £113 2s. 6d.

Spelter.—News that the formation of a zinc cartel had been finally abandoned came rather as a surprise, for hopes of an agreement had run high. Two producers, one French and one Belgian, are understood to have found it impossible to fall into line. The market has weakened, but on the whole opinion is veering towards a more optimistic view.

Daily fluctuations :—

Ordinary.—Thursday, £14; Friday, £13 15s.; Monday, £13 15s.; Tuesday, £13 16s. 3d.; Wednesday, £13 16s. 3d.

Lead.—Warehouse stocks have increased from 6,236 tons at the end of October to 7,187 tons at November 30, the demand from consumers being far from satisfactory. Arrivals for this month look like being heavy.

The week's prices have been :—

Soft Foreign (Prompt).—Thursday, £15 17s. 6d.; Friday, £15 16s. 3d.; Monday, £15 11s. 3d.; Tuesday, £15 8s. 9d.; Wednesday, £15 7s. 6d.

International Illumination Congress.

Next September, an international congress, embracing every aspect of illuminating, is to be held in various centres in Great Britain, culminating in a plenary session to be staged at Trinity College, Cambridge. Dr. C. C. Paterson, Director of the Research Laboratories of the General Electric Company, Wembley, is to preside. Membership is open to members of national technical bodies, and a registration fee of £2 is imposed, but this includes a copy of the transactions and the free registration of ladies accompanying members. Application should be made to the Honorary Secretary, Mr. J. W. T. Walsh, at the National Physical Laboratory, Teddington.

Applications for Trade Marks.

The following list of applications to register trade marks is extracted from the "Trade Marks Journal" :—

"Norseman."—Metals. Alfred Field & Company, Limited, 77, Edmund Street, Birmingham.

"Condensite."—Steel. Consett Iron Company, Limited, Consett, Co. Durham.

Application to the Cutlers' Company, Sheffield.

"Nopeem."—Metals. Watson, Saville & Company, Limited, Bruce Crucible Steel Works, Mowbray Street, Sheffield.

South African Manganese Industry.—The recent opening of the railway line from Koopmansfontein to Postmasburg can be said to mark the start of a new and important branch of the mineral industry of South Africa. The new railway is 65¼ miles long, and has a ruling gradient of 1 in 100. With the loading plant at Congella completed and in service, it should now be possible to settle down to regular shipments of ore on a big scale. The guaranteed tonnage for the first twelve months is 200,000, and for the next nine years 350,000. The next stage in the Union's manganese industry will be to lay down a ferro-manganese plant capable of treating 50,000 tons of ore a year, within five years of the day when the railway was opened.—"The S.A. Mining and Engineering Journal."

Titanium.—Although titanium was discovered 141 years ago, it is only within the past 10 or 15 years that any extensive use for its ores has been found, according to the U.S. Bureau of Mines. Titanium ranks as one of the more abundant elements, is widely distributed, and occurs in concentrated form in numerous deposits, according to Mr. E. P. Youngman, in a report just made public by the Bureau. Ferro-alloys containing the element were largely used for a time, especially in connection with the manufacture of Bessemer-steel rails; but as American railways adopted open-hearth rails in preference to Bessemer rails, the demand for the alloys in the rail manufacture gradually dwindled into insignificance. New outlets for ferro-titanium have been found in the steel industry; and the production of titanium alloys, both in the United States and in Europe, has increased in recent years. By far the largest use of titanium at the present time, however, is in pigments.

Sterling

ROLLED STEEL

MOULDING BOXES

INCREASE OUTPUT

AND

CHEAPEN PRODUCTION

In the course of a day's work each box part must be handled several times. For quantity production, therefore, light moulding boxes are essential.

To withstand the brunt of rapid handling and the heavy pressures of the modern moulding machine, the box must be strong, rigid and unbreakable.

For the production of castings true to pattern free from fins and crossed joints, accurate moulding boxes are not only necessary but vital.

THE SOLUTION IS

THE STERLING ROLLED STEEL BOX

In no other type of moulding box will you find such uniform accuracy of pins and parting faces, nor just that correct ratio of the necessary factors to ensure long life without undue weight.

LET US HAVE YOUR ENQUIRY FOR YOUR NEXT LOT OF BOXES.

STERLING FOUNDRY SPECIALTIES LTD.

London Office:
13, VICTORIA STREET, S.W.1.

BEDFORD.

Telephone: 3345 BEDFORD.
Telegrams: "STERFLASK, BEDFORD."
Code: WESTERN UNION.

Glasgow: ALBERT SMITH & CO., 60, ST. ENOCH SQUARE, GLASGOW, C.1.
Newcastle-on-Tyne: LAWSON, WALTON & CO., LTD., HANDYSIDE ARCADE, NEWCASTLE-ON-TYNE.
Manchester: F. L. HUNT & CO., CHAPEL STREET, SALFORD, MANCHESTER.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	46	12	6
Three months	46	7	6
Electrolytic	50	0	0
Tough	47	15	0
Best selected	48	5	0
Sheets	84	0	0
India	62	0	0
Wire bars	56	15	0
Do. February	56	15	0
Do. March	56	15	0
Ingot bars	56	15	0
H.C. wire rods	54	10	0
Off. av. cash, November	46	3	8¼
Do., 3 mths. November	46	3	10½
Do., Sttlmnt., November	46	3	1½
Do., Electro, November	49	10	3
Do., B.S., November	48	1	10½
Do., wire bars, November	50	1	3
Solid drawn tubes			12d.
Brazed tubes			12d.
Wire			8d.

BRASS.

Solid drawn tubes	10½d.
Brazed tubes	11½d.
Rods, drawn	10d.
Rods, extd. or rlld.	6d.
Sheets to 10 w.g.	9d.
Wire	9d.
Rolled metal	8½d.
Yellow metal rods	6d.
Do. 4 × 4 Squares	6½d.
Do. 4 × 3 Sheets	6¾d.

TIN.

	£	s.	d.
Standard cash	111	12	6
Three months	113	0	0
English	112	15	0
Bars	114	15	0
Straits	115	17	6
Australian	113	7	6
Eastern	116	5	0
Banca	116	12	6
Off. av. cash, November	113	11	10½
Do., 3 mths., November	114	18	3¾
Do., Sttlmt., November	113	11	3

SPELTER.

	£	s.	d.
Ordinary	13	16	3
Remelted	12	7	6
Hard	11	0	0
Electro 99.9	16	0	0
English	14	2	6
India	12	0	0
Zinc dust	20	10	0
Zinc ashes	3	10	0
Off. aver., November	14	19	5½
Aver., spot, November	14	14	1½

LEAD.

	£	s.	d.
Soft foreign ppt.	15	7	6
English	17	0	0
Off. average, November	15	18	7½
Average spot, November	15	18	8½

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	24	0	0
Do. V.M. ex-whf.	24	0	0
Rods	27	0	0
Boiler plates	20	0	0
Battery plates	20	10	0

ANTIMONY.

	£	s.	d.
Special brand, Eng.	36	0	0
Chinese	25	5	0
Crude	22	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver	22	10	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	£7 17 6
45/50%	£11 10 0
75%	£18 10 0
Ferro-vanadium—	
35/50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% c. free	4/2 lb. Mo.
Ferro-titanium—	
23/25% carbon-free	11¾d. lb.
Ferro-phosphorus, 20/25%	£15 17 6
Ferro-tungsten—	
80/85%	2/3 lb.
Tungsten metal powder—	
98/99%	2/6 lb.
Ferro-chrome—	
2/4% car.	£30 10 0
4/6% car.	£23 2 6
6/8% car.	£22 2 6
8/10% car.	£22 0 0
Ferro-chrome—	
Max. 2% car.	£32 17 6
Max. 1% car.	£37 10 0
Max. 0.70% car.	£41 0 0
70% carbon-free	10d. lb.
Nickel—99% cubes, or pellets	£175 0 0
Ferro-cobalt	9/7 lb.
Aluminium 98/99%	£85 0 0
Metallic chromium—	
96/98%	2/7 lb.
Ferro-manganese (net)—	
76/80% loose	£11 0 0 to £11 10 0
76/80% packed	£12 0 0 to £12 15 0
76/80% export	£10 10 0 to £11 0 0
Metallic manganese—	
94/96% carbonless	1/4 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	£0 2 2
Finished bars, 18% tungsten	£0 3 0

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 7/32 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ½ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

	£	s.	d.		£	s.	d.
South Wales—							
Heavy steel	2	5	0	to	2	7	6
Bundled steel and shrngs.	1	15	0	to	1	18	0
Mixed iron and steel	1	17	6	to	2	0	0
Heavy cast iron	2	5	0	to	2	7	6
Good machinery for foundries					2	7	6
Cleveland—							
Heavy steel					2	6	0
Steel turnings					1	15	0
Cast-iron borings					1	10	0
Heavy forge					3	2	6
W.I. piling scrap					2	17	6
Cast-iron scrap	2	10	0	to	2	12	6
Midlands—							
Ord. cast-iron scrap					2	5	0
Heavy wrought	2	17	6	to	3	2	6
Steel turnings					1	0	0
Scotland—							
Heavy steel					2	10	0
Ordinary cast iron					2	12	6
Engineers' turnings					1	13	9
Cast-iron borings					1	15	0
Wrought-iron piling					3	0	0
Heavy machinery					2	18	0

London—Merchants' buying prices delivered yard.

	£	s.	d.
Copper (clean)	37	0	0
Brass	29	0	0
Lead (less usual draft)	14	0	0
Tea lead	10	10	0
Zinc	8	0	0
New aluminium cuttings	50	0	0
Braziery copper	34	0	0
Gunmetal	38	0	0
Hollow pewter	80	0	0
Shaped black pewter	60	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	66/-
Foundry No. 3	63/6
Foundry No. 4	62/6
Forge No. 4	62/-
Hematite No. 1	71/-
Hematite M/Nos.	70/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	78/-
„ d/d Birm.	88/6
Midlands—	
Staffs. common*	—
„ No. 4 forge*	66/-
„ No. 3 fdry.*	71/-
Shrops. basic	—
„ Cold blast, ord.	—
„ „ roll iron	—
Northants forge*	62/6
„ fdry. No. 3*	67/6
Derbyshire forge*	66/-
„ fdry. No. 3*	71/-
„ basic*	—

*d/d Black Country dist.

Scotland—	
Foundry No. 1	79/-
„ No. 3	76/6
Hem. M/Nos.	76/-
Sheffield (d/d district)—	
Derby forge	61/-
„ fdry. No. 3	66/-
Lincs. forge	—
„ fdry. No. 3	66/-
E.C. hematite	83/6
W.C. hematite	86/6
Lincs. (at furnaces)—	
Forge No. 4	—
Foundry No. 3	—
Basic	—
Lancashire (d/d eq. Man.)—	
Derby forge	64/6
„ fdry. No. 3	69/6
Staffs foundry No. 3	69/6
Dalzell, No. 3 (special)	105/- to 107/6
Summerlee, No. 3	91/-
Glengarnock, No. 3	—
Eglinton, No. 3	91/-
Gartsherrie, No. 3	91/-
Monkland, No. 3	91/-
Shotts, No. 3	91/-

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.		£	s.	d.
Bars (cr.)	10	0	0	to	10	15	0
Nut and bolt iron	8	15	0	to	9	0	0
Hoops	10	15	0	to	12	0	0
Marked bars (Staffs) f.o.t.					12	10	0
Gas strip	10	15	0	to	12	0	0
Bolts and nuts, ¾ in. × 4 in.					15	5	0
Steel—							
Ship plates	8	15	0	to	8	17	6
Boiler plts.	9	7	6	to	10	5	0
Chequer plts.					10	12	6
Angles					8	7	6
Tees					9	7	6
Joists					8	10	0
Rounds and squares, 3 in. to 5½ in.					9	7	6
Rounds under 3 in. to ¼ in. (Untested)					7	12	6
					and upwards		
Flats—8 in. wide and over					8	12	6
„ under 8 in. and over 5in.					8	17	6
Rails, heavy					8	10	0
Fishplates					12	0	0
Hoops (Staffs)	9	5	0	to	9	10	0
Black sheets, 24g.	8	12	6	to	9	12	6
Galv.cor.shts., 24g.					11	5	0
Galv fencing wire, 8g. plain					12	0	0
Billets, soft	5	12	6	to	6	5	0
Billets, hard	7	10	0	& up.			
Sheet bars	5	0	0	to	5	12	6
Tin bars	5	0	0	to	5	12	6

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	1/1
Sheet to 10 w.g.	1/1½
Wire	1/2
Rods	1/1½
Tubes	1/6
Castings	1/1

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	per lb.
Ingots for raising	8d. to 1/2
Rolled—	
To 9 in. wide	1/2 to 1/8
To 12 in. wide	1/2½ to 1/8½
To 15 in. wide	1/2½ to 1/8½
To 18 in. wide	1/3 to 1/9
To 21 in. wide	1/3½ to 1/9½
To 25 in. wide	1/4 to 1/10
Ingots for spoons and forks	8d. to 1/4½
Ingots rolled to spoon size	11d. to 1/7½
Wire round—	
3/0 to 10 G.	1/5½ to 2/0½

with extras according to gauge.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	18.76
No. 2 foundry, Valley	17.00
No. 2 foundry, Birm.	14.00
Basic	18.76
Bessemer	19.26
Malleable	19.26
Grey forge	18.76
Ferro-mang. 80%	94.00
O.-h. rails, h'y, at mill	43.00
Billets	31.00
Sheet bars	31.00
Wire rods	36.00
	Cents.
Iron bars, Phila.	2.09
Steel bars	1.60
Tank plates	1.60
Beams, etc.	1.60
Skelp, grooved steel	1.60
Skelp, sheared steel	1.70
Steel hoops	1.95
Sheets, black, No. 24	2.45
Sheets, galv., No. 24	2.95
Sheets, blue an'l'd, No. 13	2.05
Wire nails	1.95
Plain wire	2.30
Barbed wire, galv.	2.60
Tinplates, 100-lb. box	$5.00

COKE (at ovens).

Welsh foundry	25/- to 27/6
„ furnace	16/- to 18/-
Durham and Northumberland—	
„ foundry	15/- to 15/6
„ furnace	14/6
Midlands, foundry	—
„ furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 box	15/9 to 16/-
„	28×20 „	32/-
„	20×10 „	23/3
„	18½×14 „	17/-
C.W.	20×14 „	15/-
„	28×20 „	30/6
„	20×10 „	21/6
„	18½×14 „	16/9
Terneplates	28×20	31/- per box basis f.o.b.

SWEDISH CHARCOAL IRON & STEEL.

Pig-iron	£6 0 0 to £7 10 0
Bars, hammered, basis	£17 10 0 to £18 10 0
Bars and nail-rods, rolled, basis	£15 17 6 to £16 15 0
Blooms	£10 0 0 to £12 0 0
Keg steel	£32 0 0 to £33 0 0
Faggot steel	£20 0 0 to £24 0 0
Bars and rods dead soft, steel	£11 0 0 to £14 0 0

All per English ton, f.o.b. Gothenburg.

TUBES AND FITTINGS.

Over ½ in. up to 6 in.

	Tubes.	*Fittings.*
Gas	62½%	47½%
Water ..	58½%	42½%
Steam ..	55%	37½%

W.I. 12½% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.		
Dec.	4 ..	48	17	6	dec.	7/6
,,	5 ..	48	0	0	,,	17/6
,,	8 ..	47	6	3	,,	13/9
,,	9 ..	46	15	0	,,	11/3
,,	10 ..	46	12	6	,,	2/6

Electrolytic Copper.

		£	s.	d.		
Dec.	4 ..	53	0	0	dec.	40/–
,,	5 ..	52	10	0	,,	10/–
,,	8 ..	51	0	0	,,	30/–
,,	9 ..	51	0	0	No change	
,,	10 ..	50	0	0	dec.	20/–

Standard Tin (cash).

		£	s.	d.		
Dec.	4 ..	112	15	0	dec.	27/6
,,	5 ..	113	0	0	inc.	5/–
,,	8 ..	112	5	0	dec.	15/–
,,	9 ..	111	12	6	,,	12/6
,,	10 ..	111	12	6	No change	

Tin (English ingots).

		£	s.	d.		
Dec.	4 ..	113	15	0	dec.	30/–
,,	5 ..	114	0	0	inc.	5/–
,,	8 ..	113	5	0	dec.	15/–
,,	9 ..	112	15	0	,,	10/–
,,	10 ..	112	15	0	No change	

Zinc Sheets (English).

		£	s.	d.		
Dec.	4 ..	24	0	0	No change	
,,	5 ..	24	0	0	,,	,,
,,	8 ..	24	0	0	,,	,,
,,	9 ..	24	0	0	,,	,,
,,	10 ..	24	0	0	,,	,,

Spelter (ordinary).

		£	s.	d.		
Dec.	4 ..	14	0	0	dec.	3/9
,,	5 ..	13	15	0	,,	5/–
,,	8 ..	13	15	0	No change	
,,	9 ..	13	16	3	inc.	1/3
,,	10 ..	13	16	3	No change	

Lead (English).

		£	s.	d.		
Dec.	4 ..	17	5	0	No change	
,,	5 ..	17	5	0	,,	,,
,,	8 ..	17	0	0	dec.	5/–
,,	9 ..	17	0	0	No change	
,,	10 ..	17	0	0	,,	,,

AVERAGE MONTHLY PRICES OF STEEL SHIP PLATES (NORTH OF ENGLAND).

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1896	5 0 0	5 0 0	5 2 6	5 2 6	5 2 6	5 0 0	5 0 0	5 0 0	5 0 0	5 2 6	5 10 0	5 10 0	5 2 6
1897	5 10 0	5 10 0	5 10 0	5 7 6	5 2 6	5 2 6	5 0 0	5 0 0	5 0 0	5 0 0	5 7 6	5 10 0	5 5 5
1898	5 10 0	5 8 9	5 8 9	5 10 0	5 16 3	5 18 9	5 17 6	6 0 0	6 2 6	6 5 0	6 10 0	6 15 0	5 18 6½
1899	6 15 0	7 0 0	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 12 6	7 12 6	7 12 6	7 12 6	8 0 0	7 6 5½
1900	8 0 0	8 0 0	8 2 6	8 5 0	8 7 6	8 7 6	8 7 6	8 0 0	8 0 0	8 0 0	7 10 0	7 0 0	8 0 0
1901	6 15 0	6 15 0	6 5 0	6 0 0	6 0 0	6 0 0	6 0 0	6 5 0	6 7 6	6 5 0	6 0 0	6 0 0	6 4 4
1902	5 17 6	5 12 6	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 10 0	5 14 7½
1903	5 10 0	5 10 0	5 15 0	6 0 0	6 0 0	6 0 0	5 12 0	5 12 6	5 12 6	5 12 6	5 12 6	5 10 0	5 13 11
1904	5 7 6	5 10 0	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 11 10
1905	5 15 0	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	6 0 0	6 10 0	7 0 0	7 0 0	6 2 3½
1906	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 10 0	7 0 10½
1907	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 0 0	7 0 0	7 8 4
1908	6 10 0	6 10 0	6 10 0	6 5 0	6 5 0	6 5 0	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	6 3 9
1909	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	5 15 0	5 15 0	5 15 0	6 0 0	6 0 0	6 0 0	6 0 0	5 18 9
1910	6 5 0	6 5 0	6 7 6	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 15 0	6 15 0	6 15 0	6 10 2
1911	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 18 4	6 15 3½
1912	7 3 9	7 5 0	7 5 0	7 12 6	7 15 0	7 15 0	7 15 0	8 0 0	8 0 0	8 0 0	8 2 0	8 5 0	7 14 10
1913	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	7 19 0	7 15 0	7 3 0	6 15 0	6 10 0	7 16 5½
1914	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 0 0	6 0 0	7 0 0	7 5 0	7 5 0	7 6 3	7 10 0	6 14 8½
1915	8 0 0	8 10 0	9 0 0	9 10 0	9 10 0	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	10 5 0	11 0 0	9 12 11
1916	11 7 6	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 9 2
1917	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0
1918	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0
1919	11 10 0	14 0 0	14 0 0	14 0 0	17 0 0	17 7 6	17 15 0	18 5 0	18 5 0	18 5 0	19 12 6	21 5 0	16 15 5
1920	22 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	24 0 0	24 10 0	24 5 0	24 5 0	23 13 4
1921	23 5 0	22 10 0	20 4 0	19 0 0	19 0 0	17 0 0	15 0 0	14 15 0	13 12 0	12 5 0	10 10 0	10 10 0	16 9 3
1922	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 4 0	10 0 0	9 7 6	9 4 0	9 5 0	9 5 0	9 5 0	9 18 4½
1923	9 7 6	9 15 0	10 5 0	10 10 0	10 10 0	10 10 0	9 18 9	9 17 6	9 17 6	9 17 6	9 18 6	10 6 10½	10 1 2½
1924	10 1 6	9 18 1½	9 17 6	9 17 6	9 17 6	9 19 4½	10 5 0	10 5 0	10 5 0	9 19 0	9 15 0	9 15 0	9 19 7½
1925	9 14 0	9 10 0	9 10 0	9 1 3	9 0 0	9 0 0	8 17 0	8 13 1½	8 7 6	8 5 6	7 16 3	7 14 3	8 15 8½
1926	7 12 2½	7 12 6	7 12 6	7 14 4½	7 15 0	7 16 10½	8 2 6	8 2 6	8 4 0	8 12 6	8 12 6	8 16 3	8 1 1½
1927	8 17 6	8 17 6	8 11 6	8 7 6	8 6 3	8 5 0	8 5 0	8 3 9	8 2 6	8 2 6	8 5 0	8 5 0	8 7 5
1928	8 2 6	8 5 0	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 6 10½
1929	8 7 6	8 7 6	8 7 6	8 7 6	8 10 6	8 12 6	8 12 6	8 12 6	8 12 6	8 12 6	8 12 6	8 13 9	8 10 9½
1930	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	—	—

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Would you like to know more about him? How, in spite of his "One Exception," he is being educated and, when older, technically trained and usefully employed.

There is a long waiting list of "Peters" throughout the British Isles, for whom training and accommodation must be provided in the immediate future.

Will you help with a donation or annual subscription? Any sum, large or small, will be gratefully received.

Here's a suggestion. Your eyesight is worth 3d. a year to you. Send Peter and his handicapped pals 3d. for every year you've had it. Now, please, in case it slips your memory. Good idea?

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